APPENDIX F

POLYMER COATING SPECIFICATIONS

SPECIFICATION
FOR THE
APPLICATION
OF
C2033
TO
CONCRETE / CEMENT
SUBSTRATES

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KEY PROPERTIES OF SILOXIRANE C2033

Siloxirane C2033 is a surface tolerant, high-corrosion resistant, protective barrier. C2033 will bond to oil soaked concrete due to its oil absorbant qualities.

HANDLES:

* Up to 98% Sulphuric Acid
* Hcl, Nitric, Acetic Acids
* Methylene Chloride, Acetone, Tetrahydrofuran, Toluene, Dimethyl Formamide, Methanol, Ketones
* Caustics
* Sodium Hypochlorites
* Sea Water
* Oils, Skydrol, etc.

Note: See Chemical Resistance Chart for specific recommendation.

TOUGH, FLEXIBLE
HIGH BUILD
AMBIENT CURE
EASILY REPAIRABLE
STEAM CLEANABLE
OUTSTANDING ABRASION RESISTANCE
NON-ABSORBING IMPERMEABLE BARRIER
EXTREMELY LOW VOC - 8 gms/ml

1.0 RESINS SPECIFICATION DATA

WEIGHT ----- (lbs./gallon)	11.0
SOLIDS CONTENT ----- (% by volume)	87.4
RECOMMENDED DRY FILM THICKNESS ----- (mils)	18 - 22
RECOMMENDED WET FILM THICKNESS ----- (mils/coat)	10 - 12
THEORETICAL COVERAGE AT RECOMMENDED FILM THICKNESS -- (square feet per gallon)	72
PRACTICAL COVERAGE AT RECOMMENDED FILM THICKNESS -- (square feet per gallon)	62

1.1 CATALYST SPECIFICATION DATA

CATALYST RATIO (% resin by weight)	7.0%
POT LIFE AT 80° F. (minutes)	60
POT LIFE AT 110° F. (minutes)	20
COLOR (wet)	Off White
COLOR (cured)	Oyster White

NOTE: *Sunlight will turn coating Yellow-Tan color.*

1.2 CURE SCHEDULE

Partial Cure -- 75° F.	3 to 4 hours
Full Cure -- 75° F.	3 to 5 days
Forced Cure -- 180° F.	4 hours

2.0 CONCRETE PREPARATION

2.1 TABLE

Index to methods of preparing concrete surface for application of coatings.

Type of Concrete	Current Condition of Concrete	Recommended Preparation
New or Old	Clean, sound concrete with no chemical attack or contamination. Roughness profile approximates medium grit sandpaper.	Method 1
New or Old	Clean, sound concrete with no chemical attack or contamination. Smooth (steel trowelled) surface.	Method 2
Old	Surface contaminated with alkalies. Smooth or rough.	Method 3
Old	Surface contaminated with acids.	Method 4
Old	Surface contaminated with oils, greases, fats, or concrete sealants. Smooth or rough.	Method 2
Old	Severely corroded or worn, exposing aggregate. Need 0.75-3.0 in. or more thick resurfacing for proper elevation and drainage.	Method 5
Old	Severely corroded or worn, exposing aggregate overall in all local areas. Resurfacing must be thin and fast-cure for minimum downtime.	Method 6
Old	Holes or ruts need filling, but resurfacing over large areas not needed.	Method 7

METHOD 1

Condition

New concrete having a wood trowel, float, or "sweat" finish so that surface is rough*; or old concrete that is free of chemical contamination or attack, but has rough* surface. Clean, sound surface.

Note 1: Concrete must be cured at least 28 days prior to application of coatings.

* Rough surface is defined as a surface profile that feels to the touch like medium flint paper.

Procedure

1. Remove protrusions or lumps with a chisel.
2. Sweep the floor to remove loose dirt.
3. Brush-blast to remove any semi-loose concrete.
4. Vacuum all sufuraces. Remove all dust and contaminates.

METHOD 2

Condition

New concrete with a smooth, steel trowelled finish or old concrete that is free of chemical contamination and has smooth surface. Clean, sound concrete.

Note 2: Concrete must be cured at least 28 days prior to application of coatings.

Procedure

Roughen surface by one of the following methods:

1. Grit-blast with 16 - 30 mesh grit to roughen the surface equivalent to the surface of medium flint paper.
2. Sweep or vacuum surface to remove dust and sand.

METHOD 3

Condition

Concrete contaminated with alkalies, smooth or rough surface.

METHOD 3, continued

Procedure

1. Remove excess alkalies by steam-cleaning or flushing floor with high-pressure water.
2. Scrub surface with a strong detergent using one pound detergent per gallon of warm water. Use power-scrubber with rotary wirebrush or use steel-bristle hand brushes for scrubbing so that all loose cement and aggregate are removed. Flush with high-pressure clean water. Dry thoroughly. If surface is smooth, brush blast or acid etch as directed in Method 2 after removing excess alkali. Check pH.

METHOD 4

Condition

Surface contaminated with acids.

Procedure

1. Flush the floor with high-pressure water.
2. Spread powdered soda ash or trisodium phosphate on the floor and wet it down with warm water.
3. Scrub the floor vigorously with steel-bristle brushes to remove all loose cement and aggregate.
4. Allow to stand for 10 minutes.
5. Rinse thoroughly with water.
6. Check the pH of the floor. If the pH is less than 7, the procedure must be repeated until a neutral or slightly alkaline surface is obtained. Allowable pH variation of the surface is 7.0 to 8.0.
7. If smooth spots remain, brush blast as directed in Method 2.

METHOD 5

Condition

Old concrete, corroded or eroded so that resurfacing is necessary to give a safe floor with proper drainage.

Procedure

This method for resurfacing is recommended where the required thickness of the new layer of concrete is more than 0.75 in. For resurfacing, as below, either Type 1 or high early strength cement may be used.

METHOD 5

Procedure, continued

1. Remove weak concrete and loose aggregate by chipping.
2. Flush with high-pressure water.
3. If the old concrete is contaminated with chemicals, use the method of cleaning and neutralizing as explained above in Method 3, 4, or 5, as needed.
4. Allow the surface to dry.
5. Apply by brush or spray one coat of modified epoxy concrete adhesive or mill approved equal.
6. Allow the adhesive to dry a minimum of 15 minutes to a maximum of 60 minutes at 75° F, or as recommended by the supplier. Adhesive should be slightly tacky; otherwise reapply.
7. Pour the new concrete mix and trowel out to the desired thickness of 0.75-3 in. or more over the area. The concrete mix may be featheredged as required. In order to provide a better surface for bonding the coatings, finish the new concrete with a wood trowel or float rather than a steel trowel.
8. If Type 1 Portland cement is used, wet cure two days and then dry-cure 28 days.
9. If high-early strength cement is used, wet-cure 24 hours and then dry-cure 14 days.
10. Sweep surface free of dirt, etc., just before coating with Siloxirane C2033.
    Note: An epoxy, latex or acrylic cement can also be used for faster turn-around.

METHOD 6

Condition

Old concrete, corroded or eroded so that resurfacing is needed. This method of resurfacing is recommended in cases where fast curing is required and the physical conditions can tolerate a thickness of only 0.25-0.75 in.

Procedure

1. Remove weak concrete and loose aggregate by chipping.
2. Flush with high-pressure water.
3. If the surface is contaminated with chemicals, use the appropriate method of cleaning as shown in Method 3, 4, or 5.
4. Apply by brush or spray one coat of modified epoxy concrete adhesive or mill approved equal.
5. Allow the adhesive to dry for 15 minutes minimum, 60 minutes maximum, at 75° F. Adhesive should be slightly tacky; otherwise, reapply.

METHOD 6

Procedure, continued

6. Trowel one coat of mortar mixed with an approved latex product at a thickness of 0.25-0.75 in. Featheredge the material as desired. Cure seven days at 75° F. foot traffic. A fast cure acrylic, latex, or epoxy cement can also be used.
7. Apply Siloxirane C2033 coating to clean surface.

METHOD 7

Condition

Old concrete with corroded or worn holes or ruts.

Procedure

1. Clean loose cement and aggregate from holes and ruts by chipping.
2. Remove chemical contamination according to Method 3, 4, or 5, as needed.
3. Prime cavities with neat epoxy grout. Allow the resin to reach tack-free state (two to four hours at 75° F) and immediately apply sand-filled mix.
4. For trowel application, mix approximately three parts of epoxy grout fine washed silica sand to one part of epoxy grout. Adjust mixture for best trowelling properties. For pourable mixture, use one to two parts fine washed silica sand to one part of epoxy grout.
5. Fill cavity with mortar, tamp, and strike off level with surrounding surfaces. Cure at least eight hours at 75° F. or until grout is hard and firm before topcoating with Siloxirane C2033.

<u>3.0</u> <u>MIXING RATIO BY WEIGHT</u>

100 parts "A" resin
7 parts "B" catalyst

3.1 Mix Part "A" resin with mixer (Jiffy type or equal) until uniform. Add Part "B" catalyst and mix for 5 to 10 minutes to get thorough mixing.

NOTE: C2033 has a viscosity low enough for airless spraying, brushing or rolling on. If additional solvent is required use methyl ethyl ketone only. Add small amounts of MEK at a time to reach required viscosity.

4.0 VOLUME CONVERSION DATA

Methyl Ethyl Ketone;	1 cc = .85 grams Boiling Point = 74° C (165° F)
Hardener;	1 cc = 1.0 grams

5.0 SPRAY EQUIPMENT DATA

5.1 AIRLESS

5.1.1 MIXING PROCEDURE

-- Mechanically agitate component A (resin).
-- Add component B and mix thoroughly for approximately 5 to 10 minutes.
-- Viscosity Zahn Cup #5 -- 12 to 13 seconds. (Add small amount MEK if required)
-- Pour mixed C2033 through 60 mesh screen into a clean can to remove any large particles.

5.1.2 EQUIPMENT

-- 30:1 to 40:1 airless pump, 3 gpm minimum, air-operated. NOTE: Teflon packings are recommended.
-- 3/8" I.D. airless spray hose.
-- .19-.023 airless tip with reverse cleaning valve.
-- #50-#60 mesh inline filter.
-- Filter on siphon line recommended.
-- Compressor specification: minimum 50 CFM at 100 psi output.
-- Air input line - 1/2" I.D. minimum.

5.2 CONVENTIONAL SPRAY

5.2.1 MIXING PROCEDURE

-- Mechanically agitate component A (resin) while adding 5-10% MEK. -- Viscosity Zahn Cup #5 -- 8 to 9 seconds.
-- Continue mixing component A until thinner is thoroughly mixed.
-- Add component B and mix thoroughly for approximately 5 to 10 minutes.
-- Pour mixed C2033 through 60 mesh screen into a clean can to remove any large particles.

5.2.2 EQUIPMENT

-- Suggested spray guns (all stainless steel parts):
A) Binks Model 18 with 66 SK nozzle
B) DeVilbiss P-MBC or JGA with FX fluid tip and 704 air cap approximately .043" I.D. fluid tip. -- 1/2" I.D. Fluid hose and 5/16" I.D. Air hose.
-- Binks or equal; agitation and dual pressure 2 gallon or 5 gallon pot.

5.2.2 EQUIPMENT, continued

-- Extractors, water and oil; use dual water and oil extractors when using air type system.
   A) Extractor only - Binks 86-944 or equal
   B) Extractor Regulator - Binks 86-949 or equal

For small jobs a dual internal and external mix spray gun will do.

**NOTE: When using air spray, be sure to remove all water and oil from air.

<u>6.0</u> <u>APPLICATION</u> <u>PROCEDURES</u>

6.1 Substrate temperature must be greater than 10 degrees above dew point temperature. **TEMPERATURE <u>MUST</u> <u>NOT</u> BE BELOW 65° F.**

6.2 After material is mixed, put under pump.

6.3 For conventional spray set pot pressure between 45 and 60 psi and air pressure between 50 and 70 psi. For airless spray open air supply valve slightly to fill hose with material.

6.4 Take the spray gun to a safe and clear area to adjust spray pattern.
<u>Conventional</u> <u>Spray</u> -- open fluid hose to release the air, then adjust fluid and air ratio for desired spray pattern.
<u>Airless</u> <u>Spray</u> -- increase air supply to pump until desired spray pattern is reached.

6.5 Spray test sample until desired spray pattern and wet film thickness is reached.

6.6 Recommend that equipment be exclusively used for C2033 to avoid contamination with other materials. Maintain a clean environment at all times.

6.7 **NOTE:** Install adequate ventilation system to maintain optimum air safety level and to draw off solvent to promote quicker B-Staging.

6.8 On heavily pitted surfaces 1st coat should be thinner than subsequent coat to allow coating to flow into crevices and pinholes.
   First Pass should be a light tack coat.
   Second and Third Pass should be a vertical - horizontal cross hatch pattern.

6.9 It is recommended that Siloxirane C2033 be applied in two (2) coats. Each coat to be 10 to 11 mils - wet mil thickness.

6.0 APPLICATION PROCEDURES, continued

6.10 Allow first coat to dry (approximately 4 hours) prior to applying second coat.

6.11 For expansion joints, large cracks, pipe sealing, tank base sealing, wall to floor sealing, etc. - for directions see drawings RP101 to RP109 starting on page 14.

7.0 BRUSH OR ROLLER APPLICATION

7.1 After mixing, apply Siloxirane C2033 as you would any other low viscosity coating by brush or roller.

NOTE: Brush and roller material must be capable of handling MEK without deterioration.

8.0 THINNERS

C2033 as manufactured is thixatropic and contains enough solvent for airless spray. For conventional spray thinner must be added for ease of application and to promote smooth appearance. Methyl Ethyl Ketone (MEK) is specified due to good thinning characteristics without causing running or sagging. ****NOTE: MEK is a FLAMMABLE LIQUID.**

IMPORTANT: WHEN USING ANY KIND OF SOLVENT OR THINNER, BE SURE THERE IS PLENTY OF VENTILATION. NO SMOKING ---- USE A RESPIRATOR, FACE SHIELD, AND PROTECTIVE CLOTHING.

9.0 VISCOSITY

On common spray equipment there are several types of adjustments which affect the application properties. Viscosity is very important because if a coating is too thick, it will not go through the equipment and if it is too thin it will run off substrate. If the material seems to "spit" or come out agglomerate, a little thinner well mixed will allow the dispersion to be sprayed more easily.

10.0 FLUID PRESSURE (pressure forcing material to spray gun)

The same type of spitting from nozzle which is common to heavy viscosity will also show up if the fluid pressure is too high. Also an overabundance of coating landing on a surface or a general lack of smooth uniform wet coating will indicate too high a fluid pressure (either too high pump pressure or pot pressure).

11.0 AIR PRESSURE POT SPRAYING

The above recommendations on pressure and solvents should be adhered to. The following are additional points of information when using pressure pot spraying:

11.1 Air Atomization Pressure -- Since this is the air which breaks up the coating into fine particles as it leaves the orifice of the spray gun, its variation can have gross effects on the appearance of the applied coating. Too low an atomization pressure will allow the coating to land as agglomerates. In a finer state this can appear as small craters or generally a rough or pitted appearance of the applied coating. Too high an air pressure can cause a blowing of the coating which will appear as ripples on the surface or even bare spots. High atomization pressure will also cause alot of overspray. A finer appearing, smooth surface will be obtained if air pressure is carefully adjusted prior to application.

11.2 Pattern and Trigger Adjustments -- Most paint guns have adjustments to widen, narrow, and turn the spray pattern by simply turning a knob. They also have a trigger adjustment to vary the fluid to air ratio. These adjustments are useful for varying shapes and configurations, and most applicators will vary them to arrive at their most convenient settings. Each of these factors, pressure, thinner and adjustments are independent and any change in one factor can effect all other settings, but usually there is little trouble in arriving at a suitable combination.

**** NOTE: Air must be free of water and oil.**

12.0 INSPECTION AND TESTING

12.1 Large defects in appearance will be obvious, but such defects as small blisters and hairline cracks will not be apparent without close examination. Edges and inside and outside corners will usually be most likely areas for defects.

12.0 INSPECTION AND TESTING, continued

12.1:

Sparktesting or low voltage wet brush testing is recommended to pinpoint breaks in a coating which may be impossible to detect by eye. Thickness measurements are necessary to be sure weak spots are not present which spark testing and visual inspection will miss. Wet thickness gauge measurements during application will help insure uniform total coverage. Dry thickness gauge measurements after will insure no sagging has thinned out the coating.

12.2 SPARKTEST @ 5000 volts.

13.0 CORRECTING DEFECTS

A) Pinholes --
   1 - Use small drill bit or similar tool to clean and enlarge pinhole.
   2 - Fill hole with small amount of C2033 (be sure it is catalyzed).
   3 - Allow to cure.

B) Large Surfaces --
   1 - Sandblast or rough up surface with disc sander or other similar tool.
   **NOTE: Be sure to remove shiny surface at least 1 inch around perimeter of area to be repaired.
   2 - Vacuum clean.
   3 - Solvent Wash.
   4 - Apply C2033.
   5 - Cure.

14.0 RECOATING

C2033 may be recoated after hardening. The surface must first be brushblasted to remove the shiny resin rich surface. After surface preparation proceed to coat per 6.0 or 7.0.

15.0 SAFETY EQUIPMENT

1. Safety goggles or face shield.
2. Respirators - Wilson 1200 series (or equal) with organic vapor/dust mist cartridge (122110/1221105). In tank application use full face external supplied face mask (3M or equal).
3. Rubber gloves.
4. Protective clothing.
5. See attached handling instructions and health hazard data.

16.0 SAFETY PRECAUTIONS FOR HANDLING SILOXIRANE C2033

NOTE: THIS PRODUCT CAN CAUSE SKIN IRRITATION

Use following procedures while handling this product:

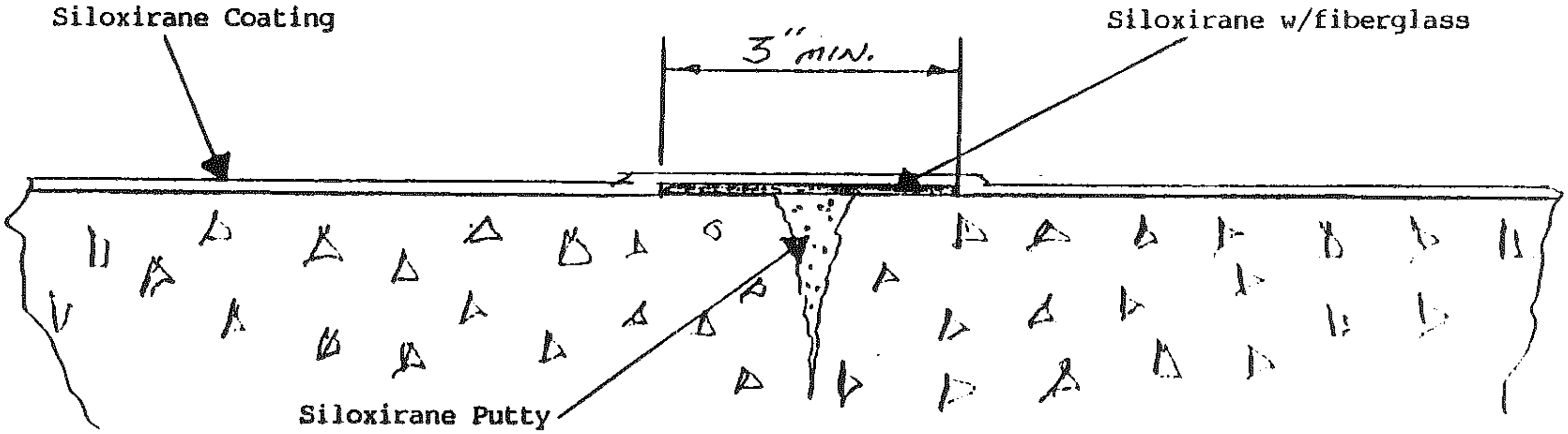
1. Ventilate tank at all times when spraying.
2. Apply skin lotion containing lanolin to hands, arms and face prior to working with coating.
3. Wear protective clothing:
   A) When mixing, preping or repairing wear rubber gloves, protective overalls, chemical goggles and gas/vapor purifying respirator.
   B) When spraying wear rubber gloves, protective overalls, plastic boots, protective hood and full face positive air pressure mask. Tape closed all openings.

   Recommendation: Install small rubber hose inside protective overalls and connect to air line to keep cool.

IMPORTANT: DO NOT WASH SKIN WITH SOLVENT TO CLEAN COATING OFF. USE SOAP AND WATER ONLY ! REAPPLY SKIN LOTION AFTER WASHING.

If you irritate skin (reddening) use Cortizone cream or Beta-Val cream (Betamethasone Valerate 0.1%). Keep away from solvents until healed.

DATE	SYM	REVISION RECORD	AUTH	DR.	CK.

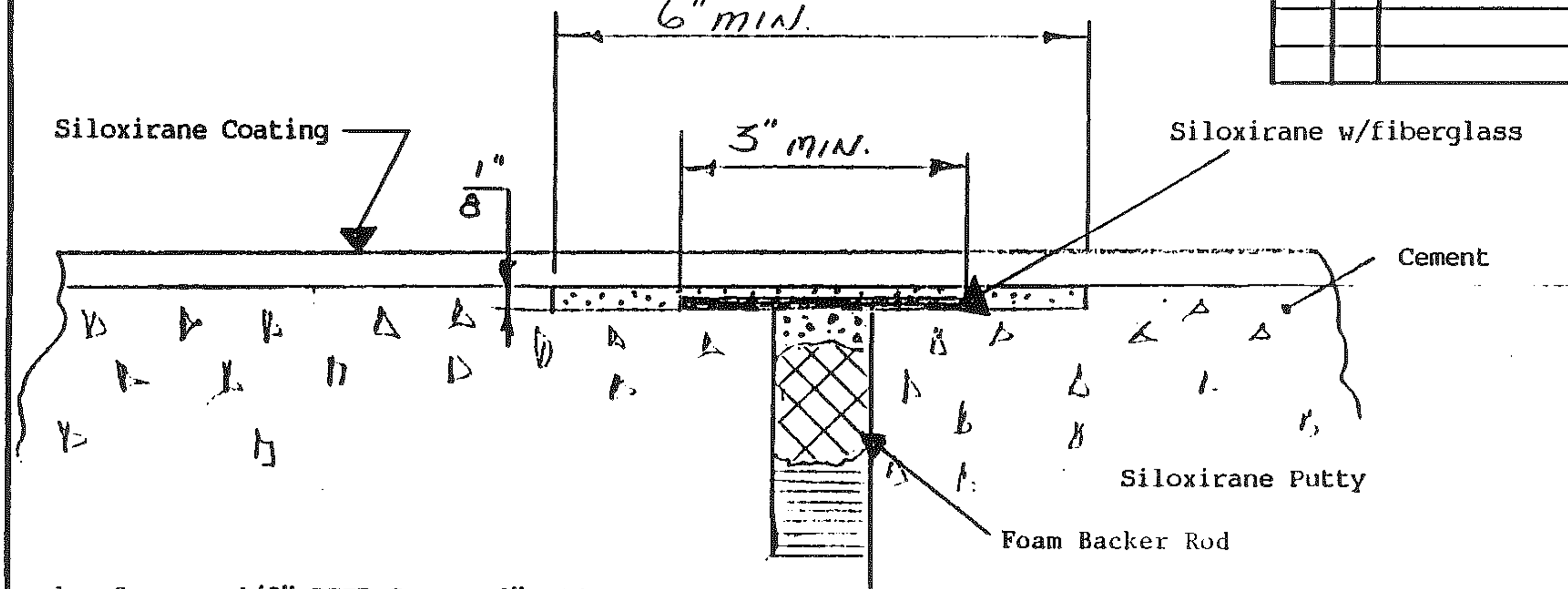


1. Blast clean crack, remove all dust and contamination.
2. Coat approximately 6 inches around crack and into crack with catalized coating, 3 to 4 mils.
3. Mix coating with dry, clean sand and make putty.
4. Fill crack with Siloxirane putty.
5. Cover filled crack with minimum 3" wide Siloxirane wetted fiberglass tape.
6. Allow to harden (3 to 4 Hours).
7. Apply Siloxirane coating to concrete and over fiberglass patch.

TOLERANCES (EXCEPT AS NOTED)	Advanced Polymer Sciences, Inc. 951 Jaycox Rd., Avon Ohio 44011		
DECIMAL ±		SCALE	DRAWN BY APPROVED BY
FRACTIONAL ±	TITLE Repairing Cracks in Cement for Siloxirane C2033		
ANGULAR ±	DATE	DRAWING NUMBER RP 101	

K&E ALBANENE ® 10 5468 ENGINEERS' STANDARD FORM
MADE IN U.S.A.

DATE	SYM	REVISION RECORD	AUTH	DR.	CK



1. Saw cut 1/8" DEEP Grove, 6" wide.
2. Blast expansion joint and remove all dust and contamination (min. 1").
3. Install Foam Backer Rod in expansion joint, leave 1/4 inch from top.
4. Coat entire cut out area with Siloxirane coating (catalized), 3 to 4 mils thick.
5. Mix balance of coating with clean, dry sand. Make putty mix and fill expansion joint.
6. Cover filled expansion joint with minimum 3" wide fiberglass tape wetted with Siloxirane.
7. Fill in balance of grove with Siloxirane putty.
8. Allow to harden (3 to 4 hours).
9. Coat all surfaces with Siloxirane coating, 20 to 22 mils.

TOLERANCES (EXCEPT AS NOTED)	Advanced Polymer Sciences, Inc. 951 Jaycox Rd., Avon, Ohio 44011		
DECIMAL ±		SCALE	DRAWN BY / APPROVED BY
FRACTIONAL ±	TITLE Expansion Joint, Counter Sunk (Siloxirane C2033)		
ANGULAR ±	DATE	DRAWING NUMBER RP 102	

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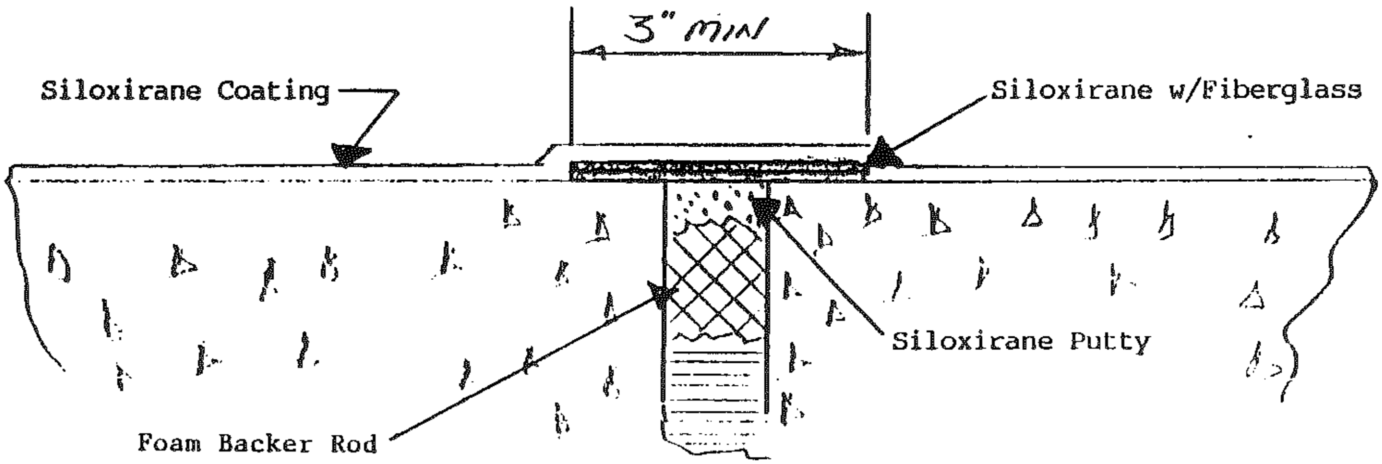
DATE	SYM	REVISION RECORD	AL.H	DR.	CK



1. Blast Expansion Joint and remove all dust and contamination (min. 1").
2. Install Foam Backer Rod in expansion joint, leave 1/4 inch from top.
3. Coat expansion joint with Siloxirane coating (catalized).
4. Mix balance of coating with clean, dry sand, make putty mix and fill expansion joint.
5. Cover filled expansion joint with minimum 3" wide fiberglass tape wetted with Siloxirane.
6. Allow to harden (3 to 4 hours).
7. Coat all surfaces with Siloxirane coating, 20 to 22 mils.

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DECIMAL ±		SCALE	DRAWN BY APPROVED BY
FRACTIONAL ±	TITLE Expansion Joint Repair for Siloxirane C2033		
ANGULAR ±	DATE	DRAWING NUMBER RP 103	

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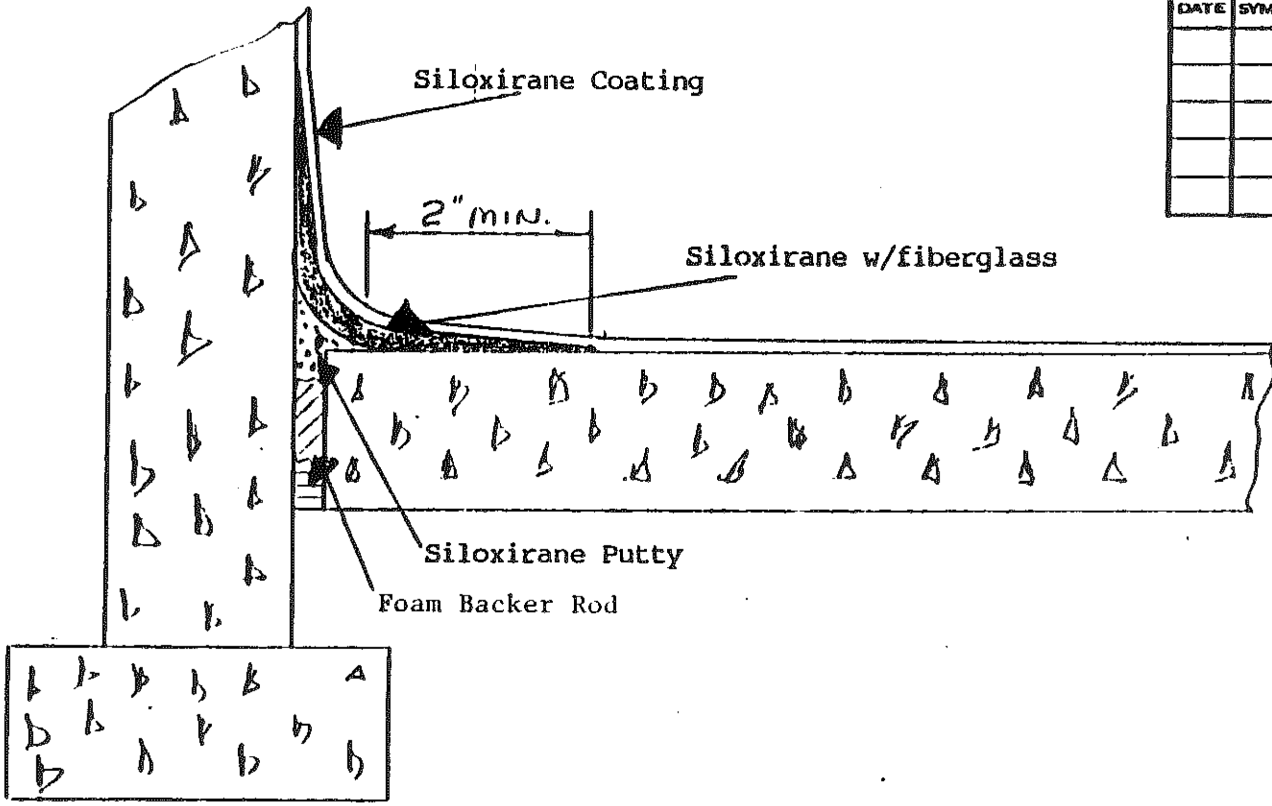
DATE	SYM	REVISION RECORD	AUTH	DR.	CK.



1. Blast Expansion Joint and vertical and horizontal surface.
2. Install Foam Backer Rod in expansion joint, leave 1/4 inch from top.
3. Coat expansion joint and minimum 2" vertical and horizontal surface with catalized Siloxirane, 3 to 4 mils thick.
4. Mix balance of Siloxirane with clean, dry sand, make putty and fill expansion joint and install 2" minimum radius rillet. Allow to harden (2 to 3 hours).
5. Cover 2" radius fillet with fiberglass wetted with Siloxirane. Cover minimum 2 inch vertical and horizontal surface. Allow to dry 3 to 4 hours.
6. Cover all surfaces with Siloxirane coating, 20 to 22 mils.

TOLERANCES (EXCEPT AS NOTED)

Advanced Polymer Sciences, Inc.
951 Jaycox Rd., Avon, Ohio 44011

DECIMAL ±

SCALE

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APPROVED BY

FRACTIONAL ±

TITLE
Wall - Floor Expansion Joint for Siloxirane C2033

ANGULAR ±

DATE

DRAWING NUMBER
RP 104

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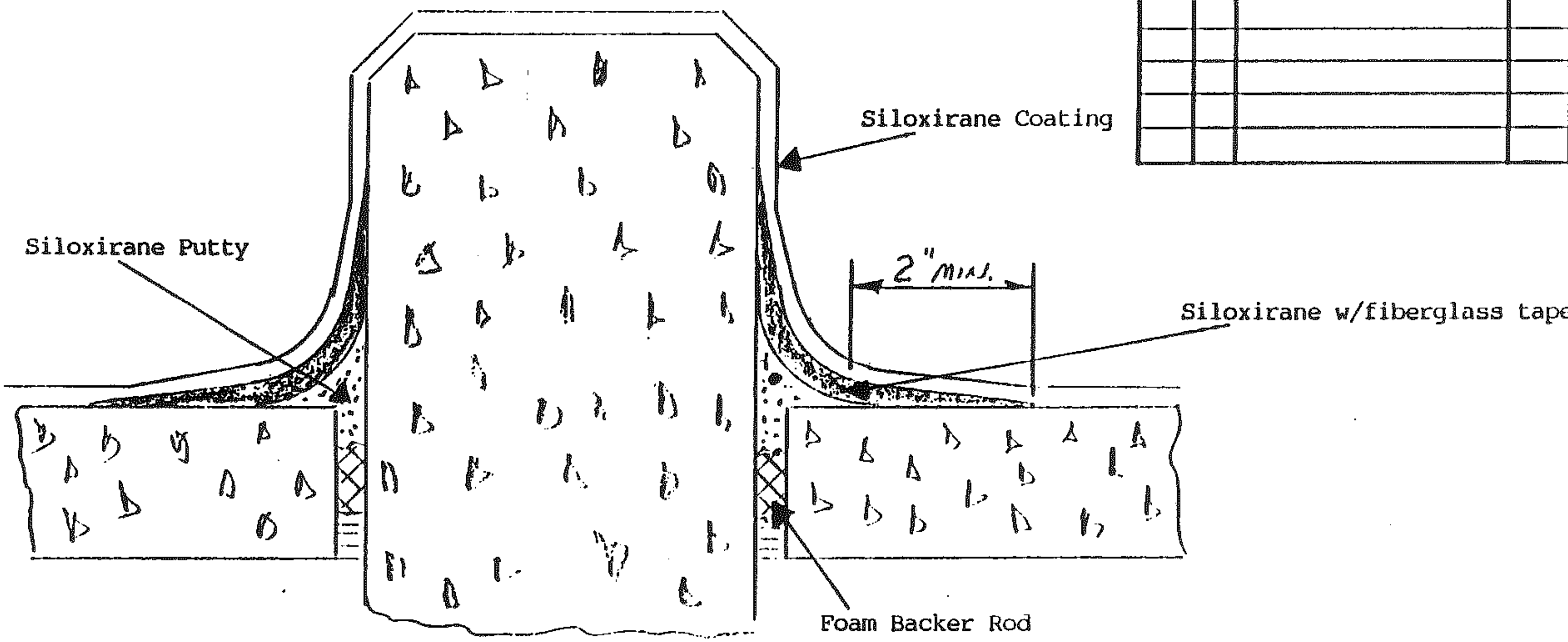
DATE	SYM	REVISION RECORD	AI	DR.	CK



1. Blast Expansion Joint and vertical and horizontal surface.
2. Install Foam Backer Rod in expansion joint, leave 1/4 inch from top.
3. Coat expansion joint and minimum 2" vertical and harizontal surface with catalized Siloxirane, 3 to 4 mils thick.
4. Mix balance of Siloxirane with clean, dry sand, make putty and fill expansion joint and install 2" minimum radius fillet. Allow to harden 2 to 3 hours.
5. Cover 2" radius fillet with fiberglass wetted with Siloxirane. Cover minimum 2 inch vertical and horizontal surface. Allow to dry 3 to 4 hours.
6. Cover all surfaces with Siloxirane coating, 20 to 22 mils.

TOLERANCES (EXCEPT AS NOTED)	Advanced Polymer Sciences, Inc. 951 Jaycox Rd., Avon, Ohio 44011		
DECIMAL ±		SCALE	DRAWN BY APPROVED BY
FRACTIONAL ±	TITLE Perimeter Expansion Joint Tank/Equipment Foundation for Siloxirane C2033		
ANGULAR ±	DATE	DRAWING NUMBER RP. 105	

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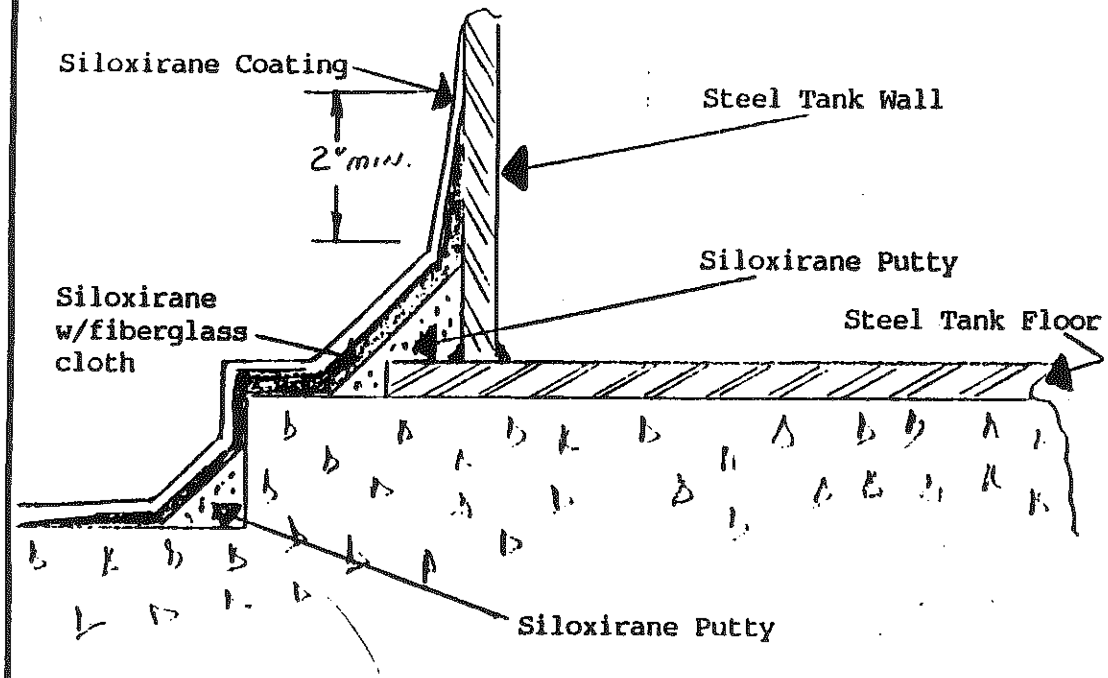

1. Steel and concrete surfaces to be blasted. Remove all dust and contamination. (Near white blast finish 4" minimum around bottom of tank)
2. Apply Siloxirane catalized coating to concrete and steel blasted areas, 3 to 4 mils.
3. Mix Siloxirane (catalized) with dry-clean sand, make putty like consistancy.
4. Fillet all corners as shown with Siloxirane putty. Allow to harden (2 to 3 hours).
5. Cover fillet, vertical steel wall (minimum 2") and concrete as shown with fiberglass cloth wetted with Siloxirane.
6. Allow to harden (2 to 3 hours).
7. Apply Siloxirane coating over all surfaces, 20 to 22 mils.

TOLERANCES (EXCEPT AS NOTED)

Advanced Polymer Sciences, Inc.
951 Jaycox Rd., Avon, Ohio 44011

DECIMAL ±

SCALE

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TITLE

Sealing Tank Ring with Siloxirane C2033

ANGULAR ±

DATE

DRAWING NUMBER

RP 106

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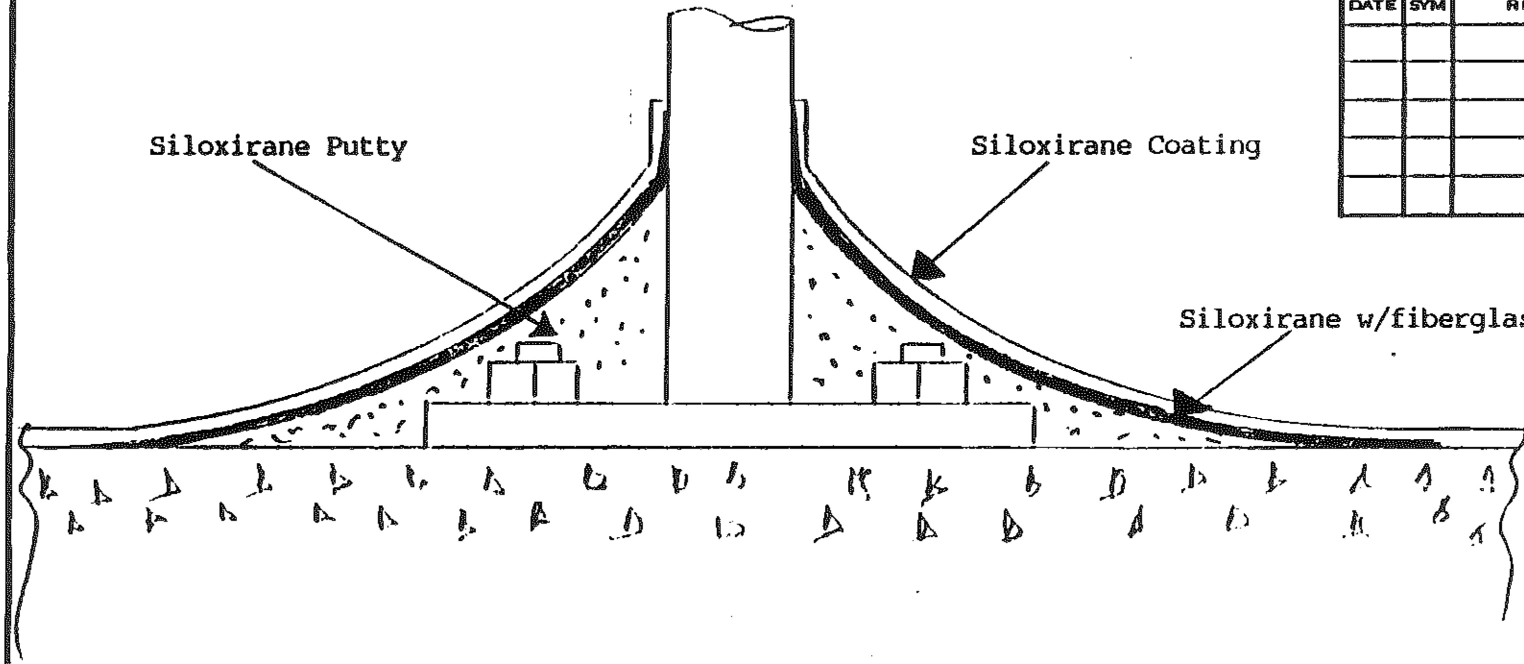

1. Blast steel surfaces to near white, blast cement area remove all dust and contamination.
2. Apply Siloxirane (Catalized) to metal and concrete extending 4 inches vertically and horizontally past steel plate
3. Mix catalized Siloxirane with dry, clean sand to make a putty.
4. Fill areas with putty as shown. Allow to harden (2 to 3 hours).
5. Apply fiberglass cloth wetted with Siloxirane as shown. Allow to harden (2 to 3 hours).
6. Coat entire surface with Siloxirane coating, 20 to 22 mils.

TOLERANCES (EXCEPT AS NOTED)	Advanced Polymer Sciences, Inc. 951 Jaycox Rd., Avon, Ohio 44011		
DECIMAL ±		SCALE	DRAWN BY APPROVED BY
FRACTIONAL ±	TITLE Sealing Pipe Stands and Pedestals w/Siloxirane C2033		
ANGULAR ±	DATE	DRAWING NUMBER RP 107	

K+E ALBANENE ® 10 9465
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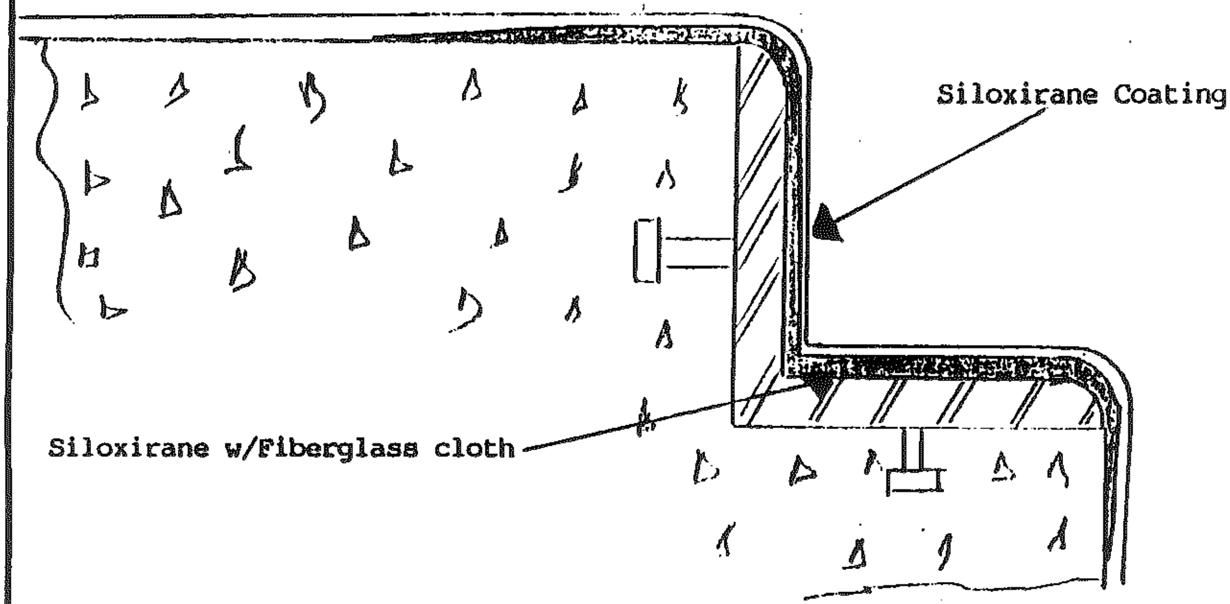
DATE	SYM	REVISION RECORD	AUTH	DR.	CK.



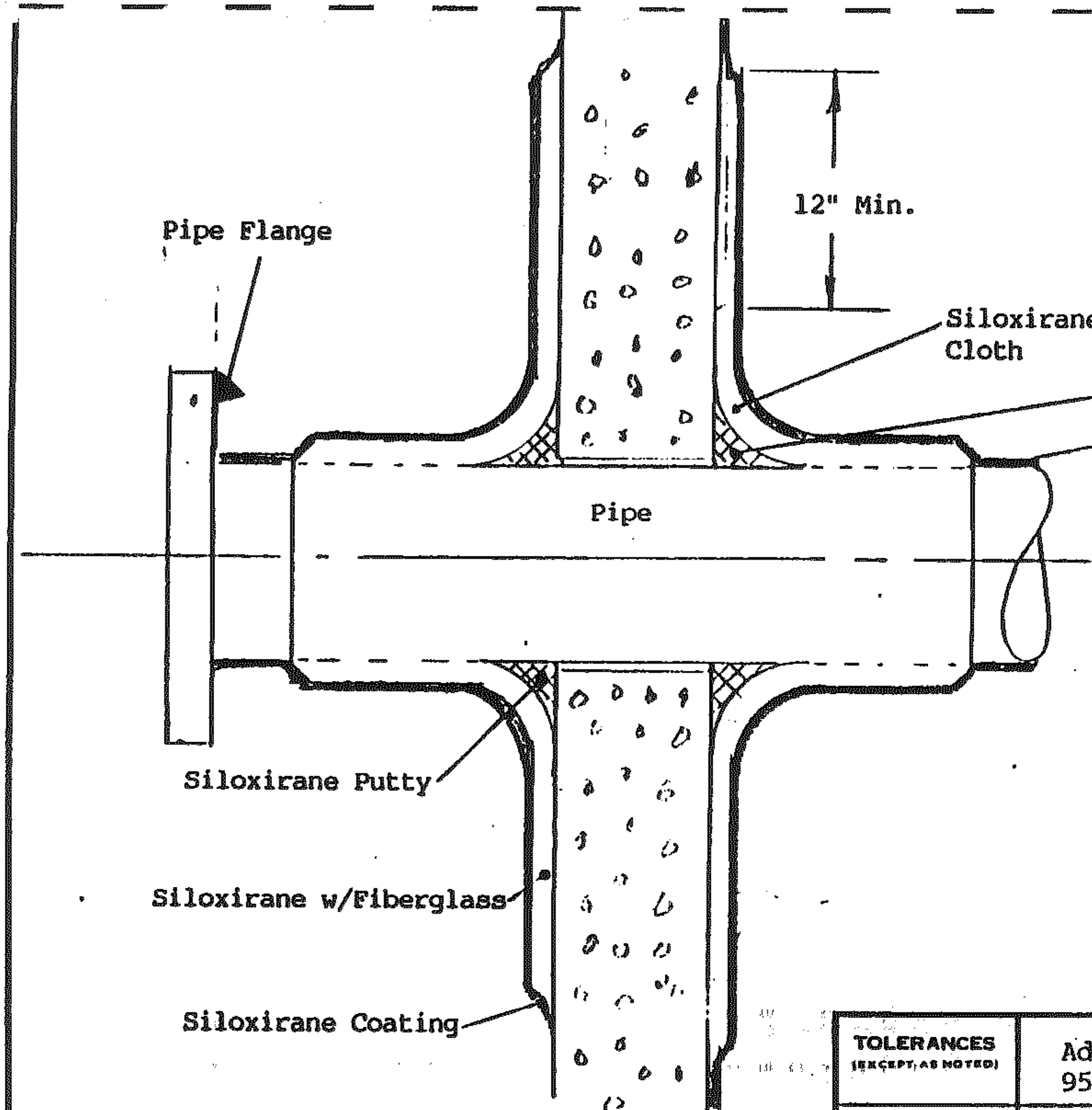
1. Blast metal grating to near white blast.
2. Blast cement and remove all dust and contamination.
3. Apply catalized Siloxirane to steel and 6 inches vertical and horizontal cement surface, 3 to 4 mils thick. Allow to tack up (1 to 2 hours).
4. Apply fiberglass cloth wetted with Siloxirane over steel and 6 inches of vertical and horizontal cement as shown. Allow to harden (2 to 3 hours).
5. Apply Siloxirane coating to all surfaces, 20 to 22 mils.

TOLERANCES (EXCEPT AS NOTED)	Advanced Polymer Sciences, Inc. 951 Jaycox Rd., Avon, Ohio 44011		
DECIMAL ±		SCALE	DRAWN BY APPROVED BY
FRACTIONAL ±	TITLE Sealing Grating Ledge w/Siloxirane C2033.		
ANGULAR ±	DATE	DRAWING NUMBER RP 108	

K•E ALBANENE ® 10 9468 ENGINEERS' STANDARD FORM

MADE IN U.S.A.

DATE	SYM	REVISION RECORD	A...H	DR.	CK.



1. Blast pipe O.D., remove all old coating 6" Dia. from pipe. Blast cement 12" minimum around pipe.
2. Install 2 to 3" radius of Siloxirane C2033 putty around pipe. Allow to harden (3 to 4 hours).
3. Apply C2033 coating around pipe, up cement 12 inches, 3 to 4 mils thick.
4. Wet out fiberglass cloth (3" wide). Lay up wetted fiberglass along pipe and up wall. Cover all of pipe and wall adjecent to pipe. Final wrap wind fiberglass around pipe. Allow to harden (3 to 4 hours).
5. Apply Siloxirane coating over all fiberglass and pipe, 20 to 22 mils.

TOLERANCES (EXCEPT AS NOTED)	Advanced Polymer Sciences, Inc. 951 Jaycox Rd., Avon, Ohio 44011		
DECIMAL ±		SCALE	DRAWN BY APPROVED BY
FRACTIONAL ±	TITLE Pipe - Cement Wall Procedure w/Siloxirane C2033		
ANGULAR ±	DATE	DRAWING NUMBER RP 109	

K+E ALBANENE ® 10 5465 ENGINEERS STANDARD FORM
MADE IN U.S.A.

G

APPENDIX G

CONSTRUCTION QUALITY ASSURANCE PLAN

Cap Construction Activities

A closure cap will be placed over the contaminated soil in and around the tank farm to eliminate infiltration and potential contact with contaminated soil, and minimize the generation of perched water. The construction activities associated with the closure cap include:

a. Clay Borrow Source Testing
b. Test Fill
c. Grading and Compaction
d. Installation of recompacted soil layer
e. Installation of flexible membrane liner
f. Installation of drainage layer and leachate collection system
g. Installation of concrete pad

a. Clay Borrow Source Testing

Description

A borrow source for the soil which will be used as the recompacted layer has yet to be selected. Selection will be based upon local availability, volume of material, and type of soil.

Inspection Activities

Initial inspection of the soil is largely visual. The engineer will look for changes in color, texture, and moisture content of the soil during excavation and transport from the borrow source to the site. The soil will also be inspected for the presence of roots, stumps, and large rocks, these items will be removed prior to use.

Sampling Activities

The borrow source soil for the recompacted soil layer will be tested for the following: Unified Soil Classification, particle size distribution, Atterburg limits, moisture-density (Proctor) relationship, permeability, unit weight per cubic foot, friction angle and cohesion. The testing methods and frequency of testing are presented in Table G-1.

b. Test Fill

Description

The test fill simulates the actual conditions of recompacted soil layer construction before the full-sized layer is built. The test fill is designed to demonstrate that the proposed clay liner is capable of achieving a maximum permeability of 1 x 10^{-7} cm/sec.

Inspection Activities

In order to obtain accurate results, the following guidelines will be used during the test fill.

- Ensure the same soil material, design specifications, equipment, and procedures proposed for the full-size cap are used to construct the test fill.

- Ensure sufficient area for conducting field tests. The test fill will be constructed, at a minimum, 1.0 feet thick, 40 feet long and 30 feet wide.

- Evaluate the methodology used to tie lifts together. The test fill will be constructed with two-six inch lifts.

- The test fill construction will include the removal and replacement of a portion of the clay liner to evaluate the methods for repair of defective portions of the full-size cap.

- Measure the thickness and observe the coverage of each layer lift.

- Observe the compaction process and test the compacted layer to ensure the specified densities are obtained.

Sampling Strategies

The following sampling strategies will be used during the test fill:

- Each lift will be compacted to at least 95% of the maximum "Standard Proctor Density", or at least 90% of the maximum "Modified Proctor Density". Density and moisture content tests will be performed on each lift using the methods and frequency presented in Table G-2.

- Permeability tests will be performed at the completion of the test fill, using the methodology and frequency presented in Table G-2.

- Field variables which control density, moisture content, and permeability to be recorded include:

    - the compaction equipment type, configuration, and weight

    - the number of passes of the compaction equipment

    - the method used to break down clods before compaction, and maximum clod size

- the method used to control and adjust moisture content, including equilibration time, and the quantity of water to be used in any adjustment

- the speed of the compaction equipment traveling over the clay liner

- the uncompacted and compacted lift thickness

If the permeability of the first test fill is greater than the specified maximum, a subsequent test fill will be constructed with adjustments to those variables which control density, moisture content, and permeability.

c. <u>Grading and Compaction</u>

Description

Grading and compaction of the soil in the solvent tank farm area will be performed prior to the installation of the recompacted soil layer (clay liner). Soil will be graded to the elevations specified on Drawings 2 and 3.

Inspection Activities

The on-site engineer will perform the following inspection activities:

- Survey the ground elevations to ensure that the specified grade is obtained.

- Inspect the soil layer to ensure that it is free of debris, and foreign materials.

- Inspect the final grade to ensure that abrupt changes in slope which may promote damage to the clay liner and FML have been removed.

Sampling Strategies

The inspection of the grading and compacting activities will be largely visual. The final elevations will be surveyed and recorded on daily construction logs.

d. Installation of Recompacted Soil Layer (clay liner)

Description

The recompacted soil layer (clay liner) will be constructed to limit maximum permeability to 1 x 10^{-7} cm/sec. The clay liner will be constructed in six inch lifts. Each lift will be compacted to 95% of the maximum "Standard Proctor Density: or 90% of the "Modified Proctor Density" and a new lift will be added until the compacted clay layer is 12 inches thick.

Inspection Activities

The following inspection activities will be performed by the on-site engineer:

- Measure the thickness and observe the coverage of each layer lift.

- Observe the compaction process and test the compacted layer to ensure the specified densities are obtained. The clay liner will be constructed using compaction equipment of the same type, configuration, and weight as used in the test fill. The speed, and number of passes for compaction will be the same as the test fill. The clay liner will be compacted at a moisture content at or higher than optimum.

- Inspect the clay liner to ensure it will be free of rocks, fractured stone, debris, cobbles, rubbish and roots. Ensure that the clod size is less than three inches.

- Survey the ground elevations to ensure that the specified elevations and clay layer thickness are obtained.

Sampling Strategies

The following sampling will be performed during the construction of the recompacted soil layer:

- Each lift will be compacted to 95% of the maximum "Standard Proctor Density" or at least 90% of the maximum "Modified Proctor Density". Density testing methods and frequency are presented in Table G-3.

- Permeability tests will be performed at the completion of each recompacted soil layer lift, using the methodology and frequency presented in Table G-3. Each lift will have a maximum permeability of 1×10^{-7} cm/sec.

e. Installation of Flexible Membrane Liner (FML)

Description

The FML will overlay the clay liner and will consist of a bentonite layer bonded to a 60 mil thick HDPE liner (Gundseal or equivalent). The liner will be brought up to the concrete pad along its perimeter to prevent lateral migration of stormwater into the cap area. The liner material will be: chemically compatible with VOCs identified in the site soil and groundwater and negligibly permeable to fluid migration. The FML will be seamed to allow no more than negligible amounts of leakage. The manufacturer's quality assurance/quality control specifications for liner installation will be followed during construction.

Inspection Activities

In addition to the manufacturer's procedures, the following inspection activities will be performed by the on-site engineer:

- Review all delivery tickets and synthetic membrane manufacturer's quality control documents to verify that the FML meets the project specifications.
- Observe that the FML placement plan is followed.
- Check all seams following the manufacturer's recommended procedures.

Sampling Strategies

The manufacturer's recommended sampling strategies will be used during the installation of the FML.

<u>f. Installation of Drainage Layer and Leachate Collection System</u>

Description

The drainage layer will consist of two units; a cushion layer consisting of clean sand, and an upper unit consisting of clean gravel. The drainage unit will have a minimum permeability of 1×10^{-2} cm/sec and a minimum slope of one percent. The cushion unit will consist of smooth, well rounded sand with a maximum grain size of 1/4 inch. The sand will contain less than 5% fines by volume. The cushion unit will have a minimum thickness of 4 inches. The upper drainage unit will consist of smooth, well rounded sand, with a maximum grain size of 3/8 inch. The gravel will contain less than 5% fines by volume. The upper unit will be installed in six inch lifts and will have a minimum thickness of 12 inches. Four inch diameter perforated PVC piping, which has been wrapped in geotextile material, will be installed within the 4 inch sand layer along the perimeter of each phase of the cap. The perforated pipe will run to a collection sump in each phase. The pipe will have a minimum slope of 0.5 %.

Inspection Activities

The following inspection activities will be performed by the on-site engineer.

Drainage Material

- Inspect the sand and gravel to ensure it is the specified size, and free from excessive fines or organic matter.

- Measure the thickness and observe coverage of each drainage layer lift.

- Survey the completed layer to ensure that specified slopes are obtained.

- Verify that the transport of fines by runoff into the drainage layer during construction is prevented by barriers or filter (e.g. silt fence)

Piping

- Observe and measure that the pipes are placed at specified locations and in specified configurations.

- Observe that pipe grades are as specified.

- Examine pipe joints for proper mechanical fit.

- Inspect the placement of filter material around the pipe.

- Observe and test backfilling and compaction are completed as specified and that, in the process, the pipe network is not damaged.

Sumps

- Observe that the sumps were not damaged during shipment.

- Measure the sumps and observe the construction materials, and compare with the specifications.

Sampling Strategies

The following sampling will be performed during the construction of the drainage layer:

- The borrow source of the sand and gravel will be tested for the following: permeability, grain size distribution, and carbonate content. The testing methods and frequency of testing are presented in Table G-4.

- Permeability tests will be performed at the completion of each drainage layer lift, using the methodology and frequency presented in Table G-4. Each lift will have a maximum permeability of 1×10^{-2} cm/sec.

g. Installation of Concrete Pad

Description

The concrete pad will be 14 inches thick, 4,000 psi (at 28 days), and reinforced to ASTM A615 Grade 40 minimum standards. A 12 inch high curb will be installed at the perimeter of the pad in each phase to provide secondary containment for the hazardous materials tank farm. A drainage swale will be cast into the concrete along one side of each phase. The surface of the concrete will be coated with an impermeable, chemically resistant coating. Appendix F contains manufacturers information for the coating.

Inspection Activities

The following inspection activities will be performed by the on-site engineer:

- Observe and test the consistency of the concrete.

- Measure the thickness of the concrete.

Sampling Strategies

The following sampling will be performed during the construction of the concrete pad:

- One set of four test cylinders (ASTM C-31) will be made per each day's pour and per each 75 cubic yards poured, but no less than one set of four cylinders per 2,500 square feet of slab poured.

- One cylinder will be tested at 7 days and two cylinders at 28 days, per ASTM C-39. The remaining cylinder will serve as a spare.

<u>Documentation</u>

1. All information pertinent to sampling will be recorded in a field log book. Entries in the log book will include the following:

   - Purpose of sampling
   - Location of sampling point

- Name and address of field contact
- Number and volume of sample taken
- Description of sampling point and sampling methodology
- Date and time of collection
- Sample Identification number
- Sample distribution and method of transport
- Field Observations
- Signatures of personnel responsible for observations

2. To establish the documentation necessary to trace sample possession from the time of collection, chain of custody records will be filled out and accompany every sample.

3. Daily construction reports will be completed by HCC maintenance manager and will be submitted to Ed Price. Construction reports include descriptions of daily activities, results of field tests, problem identification and corrective actions, and verification that all measurements conform to those required by the design specifications.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE G-1

CLAY BORROW SOURCE TEST METHODS AND FREQUENCY

Test	Method	Frequency
Grain Size	ASTM D422	1,000 yd^3
Moisture	ASTM D2216 or ASTM D3017	1,000 yd^3
Atterburg Limits	ASTM D423 and ASTM D424	5,000 yd^3
Moisture-Density Curve	ASTM D698 or ASTM D1557	5,000 yd^3 and all changes in materials
Lab Permeability	EPA, 1983 SW-870, or Daniel et.al., 1984 Daniel et.al., 1985 SW-846 Method 9100 (EPA 1984)	10,000 yd^3
Unit Weight/Cubic Foot	None Available	5,000 yd^3
Friction Angle and Cohesion	ASTM D3441 or equivalent	5,000 yd^3

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE G-2

TEST FILL TEST METHODS AND FREQUENCY

Test	Method	Frequency
Moisture-Density Relationship	ASTM D698 or ASTM D1557	4 tests/lift, minimum of 1 per 5 yd^3
Permeability (Field)	Day and Daniel, 1985	2 tests/lift, minimum of 1 per 20 yd^3
Permeability (Laboratory)	EPA, 1983 SW-870 or Daniel et.al., 1984 Daniel et. al., 1985 SW-846 Method 9100 (EPA 1984)	2 tests/lift, minimum of 1 per 20 yd^3

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE G-3

RECOMPACTED SOIL LAYER TEST METHODS AND FREQUENCY

Test	Method	Frequency
Moisture-Density Relationship	ASTM D698 or ASTM D1557	4 tests/lift, minimum of 1 per 50 yd^3
Permeability (Field)	Day and Daniel, 1985	4 tests/lift, minimum of 1 per 50 yd^3
Permeability (Laboratory)	EPA, 1983 SW-870 or Daniel et.al., 1984 Daniel et. al., 1985 SW-846 Method 9100 (EPA 1984)	2 tests on completed layer, minimum of 1 per 20 yd^3

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE G-4

DRAINAGE LAYER TEST METHODS AND FREQUENCY

Test	Method	Frequency
Grain Size	ASTM D422	500 yd^3
Carbonate Content	ASTM D4373	500 yd^3
Permeability (Field)	Day and Daniel, 1985	500 yd^3

APPENDIX H

POST CLOSURE INSPECTION PLAN

General Inspection Requirements

HCC personnel will conduct regular inspections of the tank farm cap, dewatering system, groundwater monitoring and recovery systems, and the treatment system during the post-closure period. The purpose of the inspections is to identify equipment malfunctions, structural deterioration, operation errors and discharges that could cause or lead to the release of hazardous waste constituents and adversely affect the environment or threaten human health. HCC reserves the right to modify this schedule, as well as any parts of the closure or post-closure plan, under provisions of OAC 3745-66-12(C) and OAC 3745-66-18(D).

Inspection Personnel

HCC personnel conducting the inspections will be trained by a supervisor experienced with the equipment used at the site. Inspection logs, and problem identification and corrective action reports will be completed during each inspection and kept in an operating record. Copies of these reports will be filed with Robert Hukill who will serve as the person responsible for post-closure care. Mr. Hukill can be contacted at:

Address: Hukill Chemical Corporation
7013 Krick Road
Bedford, Ohio 44146

Phone: (216) 232-9400

Frequency of Inspection

The inspection schedule is presented in Table H-1. All items on the inspection schedule will be inspected at least weekly. If certain items on the inspection schedule require more frequent inspection due to recurring malfunctions, the inspection schedule will be modified to reflect this need.

Problem Identification and Corrective Actions

The inspection schedule has been designed to identify any potential or real problems with any of the operating equipment or storage areas associated with the closure of the tank farm. The inspection schedule will allow timely identification of the problems, so corrective actions can be performed, therefore avoiding any unnecessary emergency situations at the facility. A sample inspection form is attached.

Inspection Activities

a. Concrete Pad

The concrete pad will be inspected weekly for cracks, deterioration erosion, or uneven settlement. The inspector will also look for evidence of structural damage to the pad or curb, or evidence of accumulated precipitation during any period of heavy rain.

Any visible cracks will be caulked with polysulfide caulking immediately upon discovery. Cracks which have been caulked will be recoated with the selected polymer coating, Siloxirane C2033 or equivalent. According to the manufacturer, this polymer coating has a lifetime of 40 years. Specifications and manufactures information about this polymer coating are provided in Appendix F.

b. Dewatering System

Descriptions and schedules for inspections and maintenance for the dewatering system will be included in the Operation and Maintenance manual, and will be submitted as deliverables according to the schedule in Section 6.0.

c. Groundwater Monitoring System

The groundwater monitoring wells will be inspected quarterly for physical damage and repaired accordingly. HCC personnel who conduct the inspections will be trained by a geologist who is familiar with groundwater monitoring systems. The field inspection will include:

- Verification that all wells are locked and that the locks function properly.
- Inspect all steel protective casings for signs of damage.
- Inspect all concrete collars for signs of damage.

d. Groundwater Recovery System

Descriptions and schedules for inspections and maintenance for the groundwater recovery system will be included in the Operation and Maintenance manual, and will be submitted as deliverables according to the schedule in Section 6.0.

e. Treatment System

Descriptions and schedules for inspections and maintenance for the treatment system will be included in the Operation and Maintenance manual, and will be submitted as deliverables according to the schedule in Section 6.0.

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BEDFORD, OHIO

TABLE H-1

POST CLOSURE INSPECTION SCHEDULE

Item inspected	Condition	Frequency
Trenches & Sumps	Erosion, uneven settlement, cracks, spalling in concrete, excess liquid	Weekly
Dikes	Deterioration, cracks	Weekly
Concrete Slab	Erosion, uneven settlement, cracks, spalling	Weekly
Water Stops, Caulking	Deterioration	Weekly
French Drain Sump	Erosion, uneven settlement, cracks, spalling in concrete, excess liquid	Weekly

TANK FARM POST-CLOSURE INSPECTION FORM

Item	Types of Problems	Comments
(✓) OK (x) Problem		
( ) Concrete pad	Cracks, spalling, uneven settlement, erosion, standing liquid	
( ) Dikes	Cracks, deterioration	
( ) Water Stops	Deterioration	
( ) Trench, Sumps	Cracks, spalling, uneven settlement, erosion, clogs, excess liquid	
( ) French Drain Sump	Cracks, spalling, erosion, clogs, excess liquid	

APPENDIX I

ENGINEERS CERTIFICATION OF CAP STRUCTURAL DESIGN

S. M. Haw Associates, Inc.

Professional Engineers
7300 Northfield Rd.
Cleveland, Ohio 44146
(216) 232-1220 Fax (216) 232-8744

July 7, 1993

Mr. Ed Price
Hukill Chemical Company
7013 Krick Road
Bedford, OH 44146

RE: Closure Cap at Proposed Phase I Tank Farm
Letter of Engineering Certification

Dear Ed

At your request, we are hereby making a certification statement about the protection of the closure cap which will be covered by the concrete dike of the Phase I Tank Farm.

As you know, our involvement with this project is that of structural engineers for the concrete dike. This dike has a floor which is designed as a structural mat to support the proposed tanks. This mat will spread the concentrated loads of the vessels over the earth below. In this special case, you are placing a closure cap over the earth below the dike.

The design of the cap (excluding the concrete mat) has been done by Hukill Chemical Corporation in concert with the Ohio EPA, as I understand it. Attached to this letter is a copy of your sketch, entitled "Design Detail for Closure Cap", dated 6/3/93.

The proposed construction of the materials under the dike, from bottom to top, is as follows:

1) The existing earth will be graded to the appropriate elevation and rolled to provide a dense base upon which the cap can be constructed.

2) The next layer will be 12 inches of impermeable clay, rolled in place.

3) Above the clay will be a 60 mil poly liner with a geosynthetic clay layer on its underside.

4) Above the liner will be a 4 inch sand cushion.

5) Above the sand will be a 12 inch layer of compacted, porous gravel. The purpose of the gravel is to provide an overall distance of 30 inches between the top of the dike mat and the liner.

The structural concrete dike floor will then be poured on the gravel.

The floor of the dike structure has been designed as a stiff, doubly reinforced concrete mat which will safely transfer the concentrated loadings of the tank supports onto the proposed closure cap. The loadings to the liner and the clay cap will be uniform, without sharp concentrations.

We hereby certify that the closure cap will not be harmed by the concrete dike if both the closure cap and the concrete dike are carefully constructed in accordance with the applicable plans and specifications.

If you have any questions or comments regarding this letter, please give me a call.

Very truly yours

S. M. HAW ASSOCIATES, INC.

Stanley M. Haw

Stanley M. Haw, P.E.
President

STATE OF OHIO
STANLEY M. HAW
24218
REGISTERED
PROFESSIONAL ENGINEER

Enclosure: Sketch of "Design Detail for Closure Cap" dated 6/3/93

(2054-1.LTR)

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

CLOSURE PLAN FOR SOLVENT STORAGE TANK FARM AND UNDERGROUND CISTERN

1-90

PROJECT #495-1
JANUARY 1990

EDER ASSOCIATES
CONSULTING ENGINEERS, P.C.
Locust Valley, New York
Madison, Wisconsin
Ann Arbor, Michigan

#0291G

011090

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I. INTRODUCTION

Hukill Chemical Corporation (HCC) owns and operates a chemical distribution center and solvent recovery facility located in an industrial park at 7013 Krick Road, City of Bedford, Cuyahoga County, Ohio. HCC recycles spent industrial solvents using two thin film evaporators and a fractionating distillation tower. HCC has RCRA Interim Status as a generator and storage facility and has applied for a RCRA Part B Permit.

This report presents the closure plan for the solvent tank farm (located at the north side of the plant) and underground cistern. As agreed at a November 7, 1989 meeting between the United States Environmental Protection Agency (USEPA), Ohio Environmental Protection Agency (OEPA), Hukill Chemical and Eder Associates Consulting Engineers, P.C. (EA), the proposed plan is consistent with the closure performance standard specified in Rule 3745-66-11 Ohio Administrative Code (OAC), which requires that closure substantially achieve the RCRA closure performance standard.

This closure plan complies with OAC 3745-66-97 that allows owners or operators to close tank systems in accordance with requirements that apply to landfills. This approach is warranted based on site investigations conducted by Eder Associates in April and May 1986.

II. FACILITY DESCRIPTION

General

Figure 1 is a USGS map showing the facility location with respect to the regional area. A more detailed map of the facility identifying facility boundaries, buildings and hazardous waste management unit (HWMU) locations is shown in Drawing No. 1.

Hazardous waste solvents and and spent acid are received at the facility in 55-gallon drums or in tank trucks and stored briefly prior to processing. Distilled solvent products and regenerated acid are sold for re-use. Process residues are shipped off-site to approved facilities.

Hydrogeology

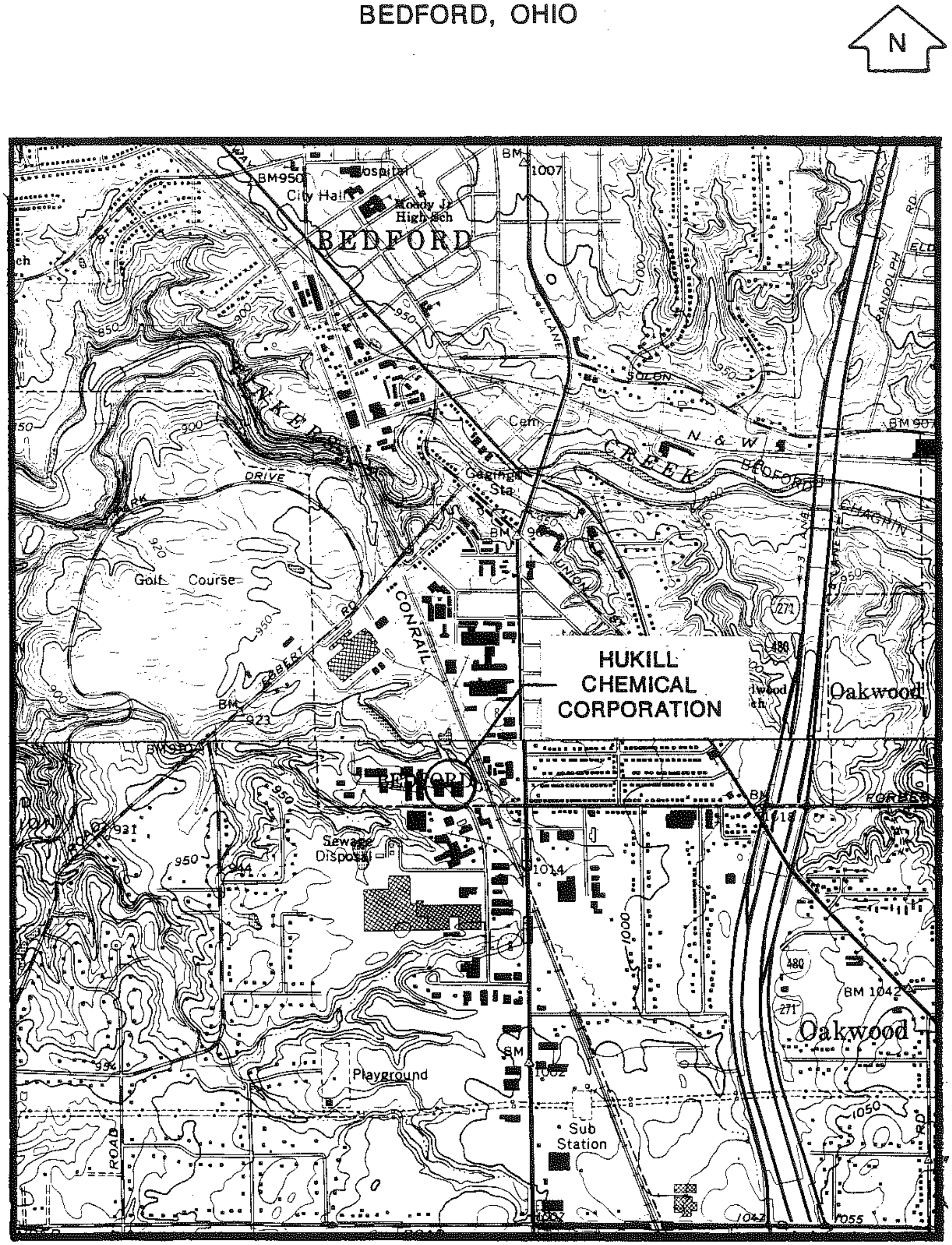
In 1986 and 1988, site investigations conducted by EA included test borings and monitoring well installations that defined the geological and hydrogeological conditions at HCC. Appendix A presents the well and soil boring locations, groundwater flow patterns, hydrogeological cross sections and detailed descriptions that were included in EA's January 1989 "Site Investigation Report."

Groundwater occurs in the weathered shale zone which is overlain by relatively impermeable silty clay fill and glacial till deposits, and which are underlain by unweathered shale. The saturated weathered shale zone is underlain by gray shale which forms the lower confining layer.

Drilling conducted at certain locations near the east process building, in the tank farm and around the cistern found perched water in fill around piping and structures. The perched water occurs above impermeable clay till deposits and is not encountered throughout the site.

FIGURE 1

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO



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USGS MAP

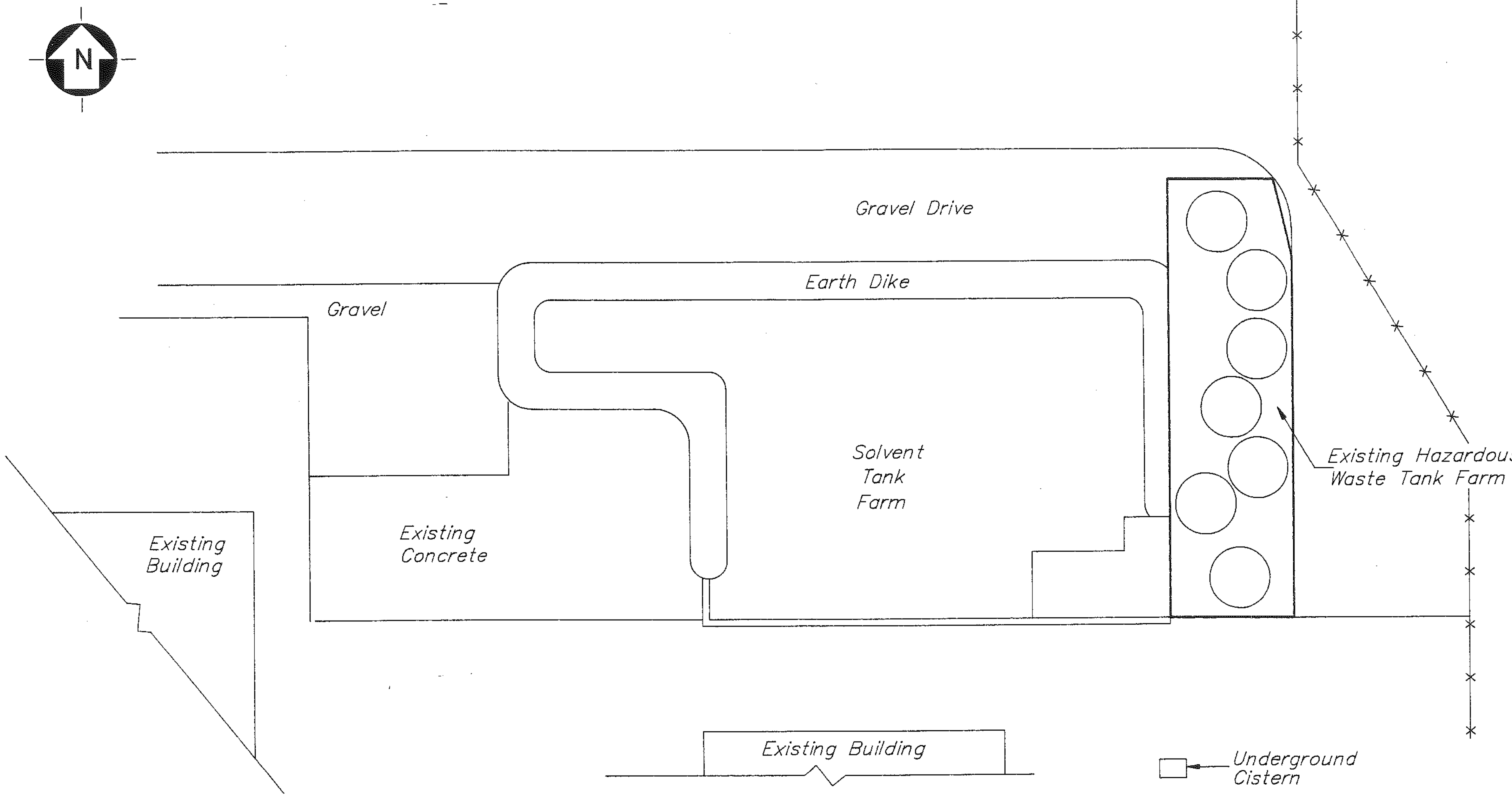
Groundwater quality at the HCC site was characterized in EA's "Site Investigation Report". There are 11 monitoring wells located on the site. Appendix B presents the groundwater monitoring results for samples collected from May 1986 to April 1988. The highest levels of VOCs (predominantly methylene chloride) were detected at Monitoring Well C, located immediately downgradient of the tank farm. The areal extent of the plume is limited to the on-site tributary to Tinker's Creek which is the groundwater discharge.

Solvent Tank Farm

Figure 2 shows a plan view of the solvent tank farm which is being closed. This tank farm was constructed to store reclaimed and waste solvents in aboveground steel tanks. The tank farm is located just north of the solvent process building and is approximately 15,000 ft^2. The southern berm of the tank farm is masonry with earthen materials forming the remainder of the berm to a height of approximately four feet. The base of the tank farm is gravel underlain by clay till.

The tank farm is dewatered by pumping accumulated precipitation from two collection sumps; one located in the northeast corner, the other in the southwest corner. There are no construction drawings available for these sumps but they are apparently open at the bottom and top, constructed of 12 in. diameter clay tile pipe, and contain gravel at approximately 9-10 ft. below grade. Precipitation accumulates in the northeast and southeast corners of the tank farm in the general area where the sumps are located.

The tank farm was used to store reclaimed and waste solvents until January 1989. The waste solvents were stored at the east side of the tank farm. In January 1989, HCC completed construction of a new tank farm to store hazardous waste solvents in compliance with OAC secondary containment requirements. The hazardous waste storage tanks were moved to this new tank farm at that time, and this tank farm is not being closed. The tank farm area being closed currently contains storage tanks for reclaimed solvents.



NOTE
Storage Tanks In Solvent
Tank Farm Not Shown
For Clarity

SK495–1G

SOLVENT TANK FARM
HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

Table 1 lists all hazardous wastes and corresponding annual quantities that have been handled in the tank farm. This waste list was used as the basis in developing the soil sampling and analysis program conducted during the site investigations. There is no waste stored in the tank farm at this time.

Soil samples were collected and analyzed for VOCs during the site investigation. The areal extent of VOCs detected in the soil around the tank farm is shown in Figure 3. The vertical distribution and extent of VOCs in the soil are shown in cross sections A-A, B-B and C-C on Figures 4, 5 and 6, respectively. In general, the vertical extent of VOC contamination in the tank farm is the depth of groundwater (17 ft. to 24 ft.). The variations in concentrations, depth and in the particular compounds detected in the soil samples indicate that their occurrence is the result of surface spills. Appendix C presents all analytical results from soil samples collected in and around the solvent tank farm.

Underground Cistern

An underground precast concrete cistern was installed around 1975 east of the HCC facility buildings. This cistern is an oval-shaped tank, approximately 5-feet high, 9 ft. in length by 6 ft. wide with a 2 piece concrete slab cover. A cross section of the cistern is shown in Figure 7. The tank has one interior baffle and one 4 in. diameter inlet pipe. The depth from grade and to the concrete cover of the cistern is approximately 8 ft. The distance from grade to the bottom of the cistern is approximately 13 ft. There are two approximately 24 in. riser manways extending from the top of the cistern to grade where they are covered by a steel plate. The inlet pipe to the cistern is located approximately 4 ft. from the bottom of the tank.

The cistern was once used as secondary containment for floor drains and trenches located in the processing building. The floor

HUKILL CHEMICAL CORPORATION

BEDFORD, OHIO

TABLE 1

HAZARDOUS WASTES HANDLED IN SOLVENT TANK FARM

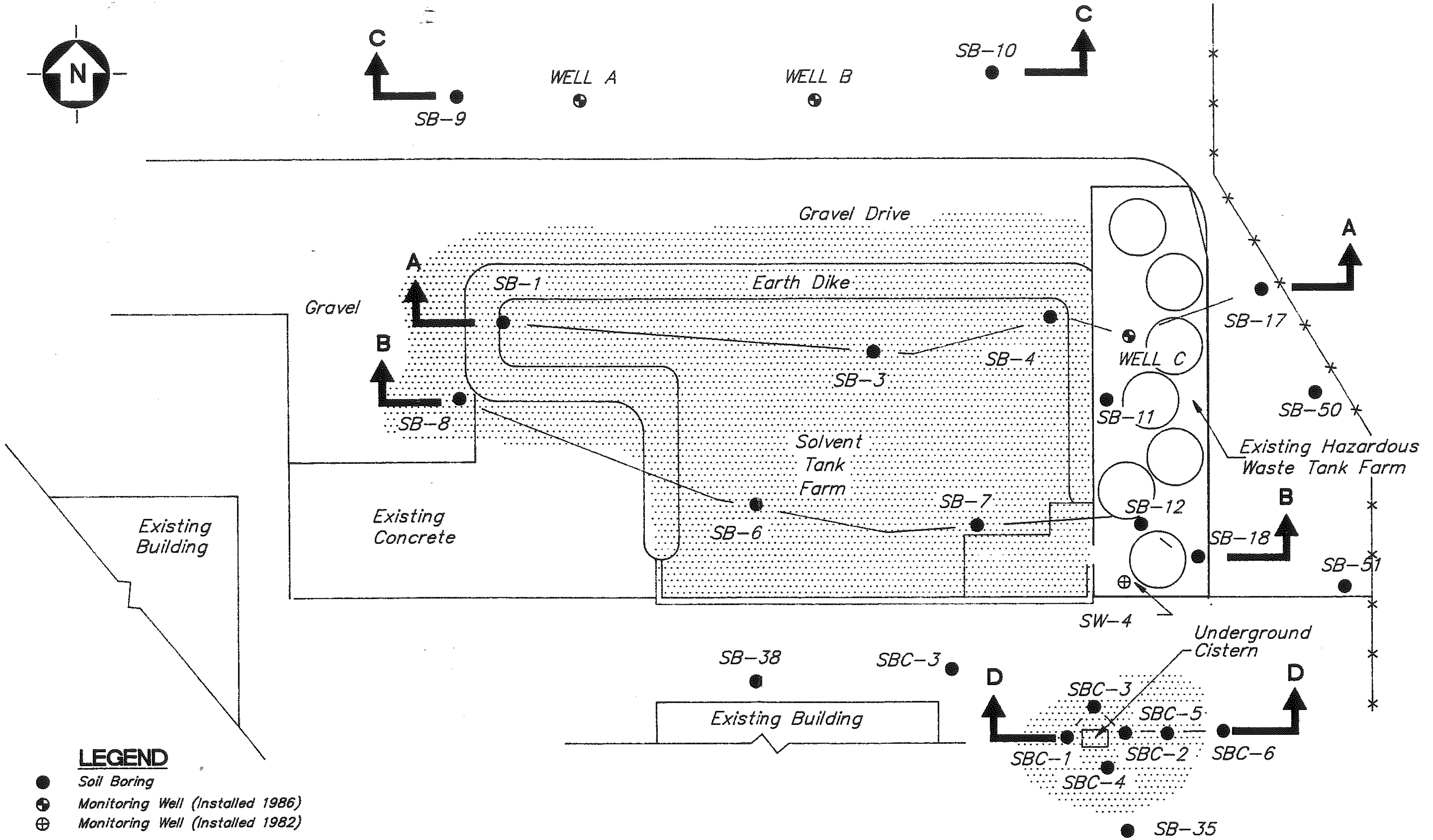
EPA Hazardous Waste No.	Waste Description	Annual[(a)] Quantity
F001	The spent halogenated solvents used in degreasing and other application, tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and the chlorinated fluorocarbons; and sludges from the recovery of these solvents.	500,000
F002	The spent halogenated solvents, tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoromethane, orthodichlorobenzene and trichlorofluormethane; and the still bottoms from the recovery of the solvents.	Included w/F001
F003	The spent non-halogenated solvents, xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, methanol, n-butyl alcohol, cyclohexanone, and the still bottoms from the recovery of these solvents.	2,716,000
F004	The following spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene, and the still bottoms from the recovery of these solvents.	78,300
F005	The spent non-halogenated solvents, toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, 2-ethoxyethanol, and the still bottoms from the recovery of these solvents.	Included w/F003
D001	General ignitable waste solvents, (flash point less than 140°F) not listed as a hazardous waste in subpart D of CFR 40, Section 261.	500,000

Table 1 Continued . . .

EPA Hazardous Waste No.	Waste Description	Annual[(a)] Quantity
U002	Acetone	200,000
U019	Benzene	Included w/above
U031	n-Butyl Alcohol	"
U037	Chlorobenzene	"
U052	Cresylic Acid	"
U080	Methylene Chloride	"
U112	Ethyl Acetate	"
U121	Trichlorofluoromethane	"
U140	Isobutyl Alcohol	"
U154	Methyl Alcohol	"
U159	Methyl Ethyl Ketone	"
U161	Methyl Isobutyl Ketone	"
U213	Tetrahydrofuran	"
U220	Toluene	"
U226	1,1,1-trichloroethane	"
U239	Xylene	"
K086	Lead, hexavalent chromium	52,800

Notes

(a) Gallons, unless noted otherwise



NOTE
Storage Tanks In Solvent Tank Farm Not Shown For Clarity

SK495-1E

AREAL SOIL DISTRIBUTION OF VOC'S IN & AROUND TANK FARM & CISTERN
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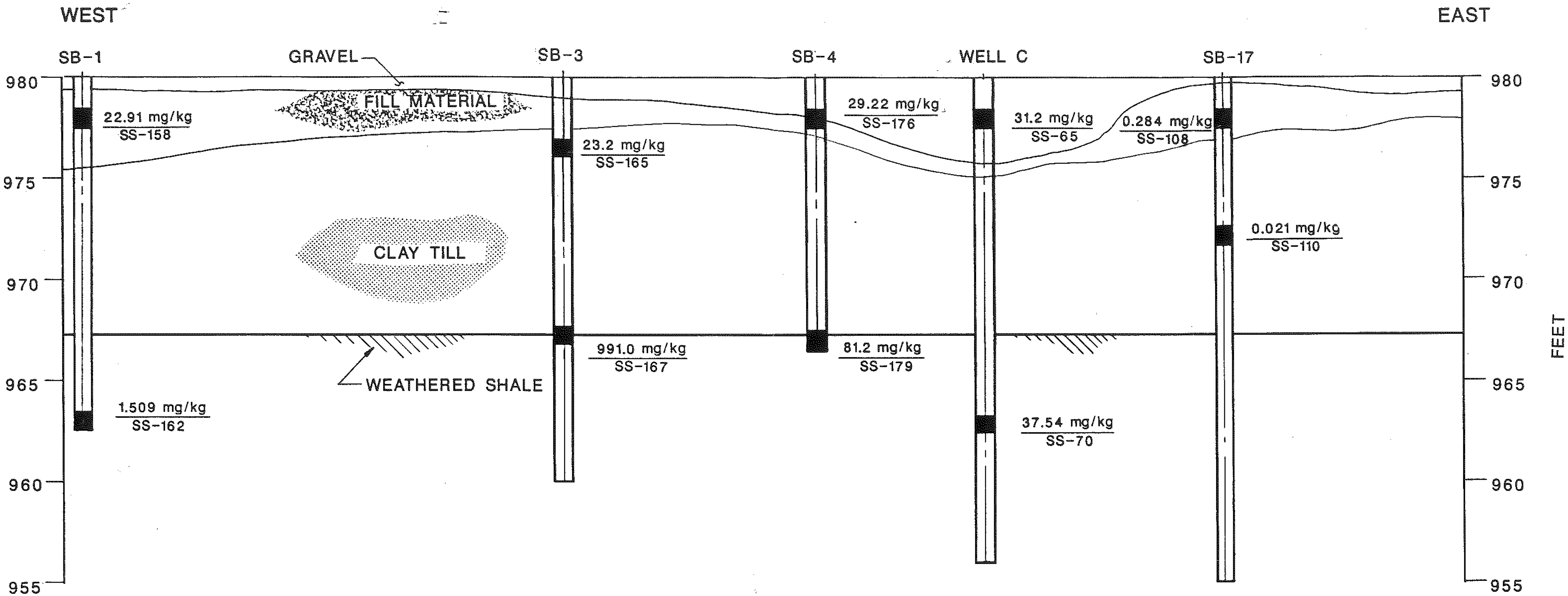
FIGURE 4



CROSS-SECTION A-A

TANK FARM BORINGS
VOC CONCENTRATIONS

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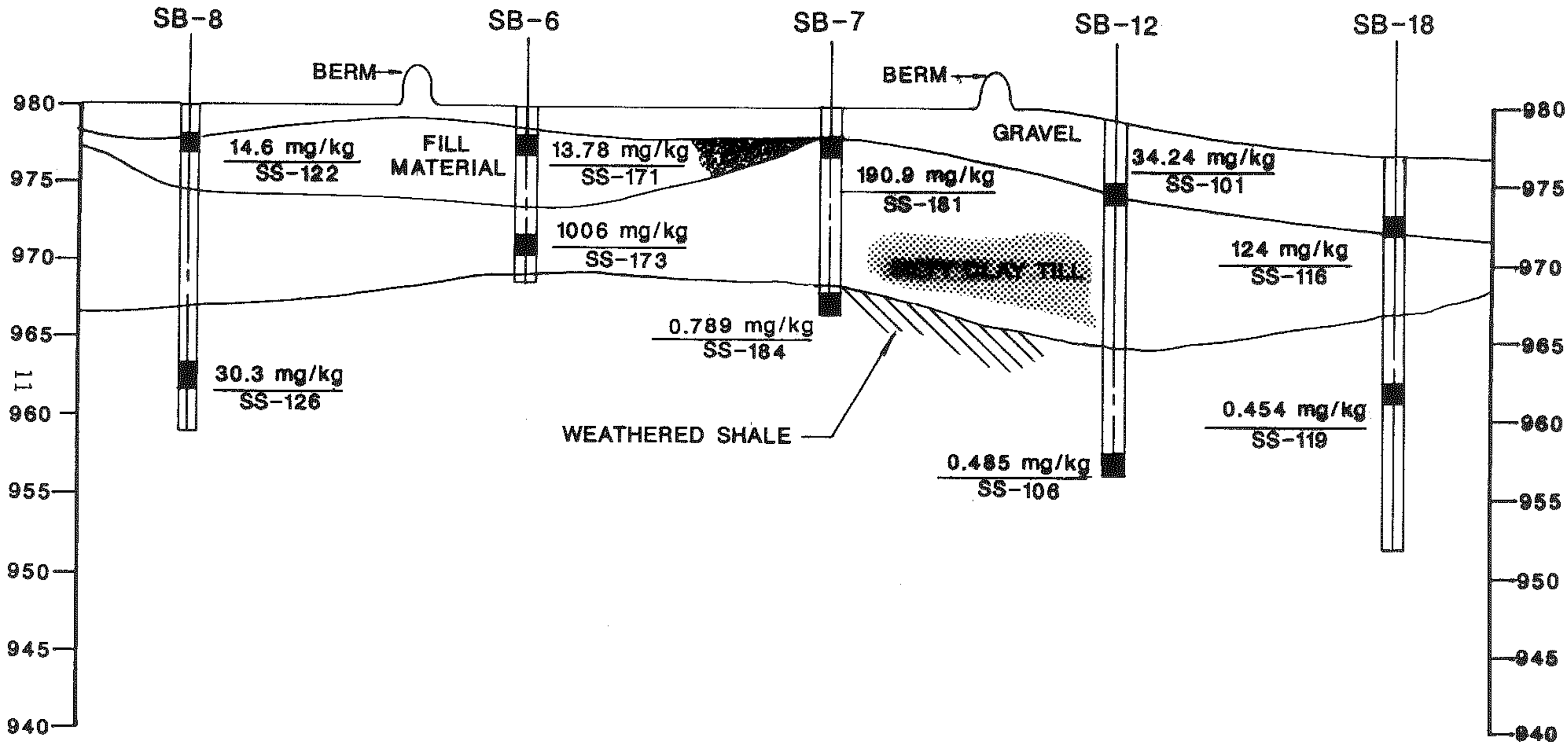

CROSS SECTION B-B

FIGURE 5

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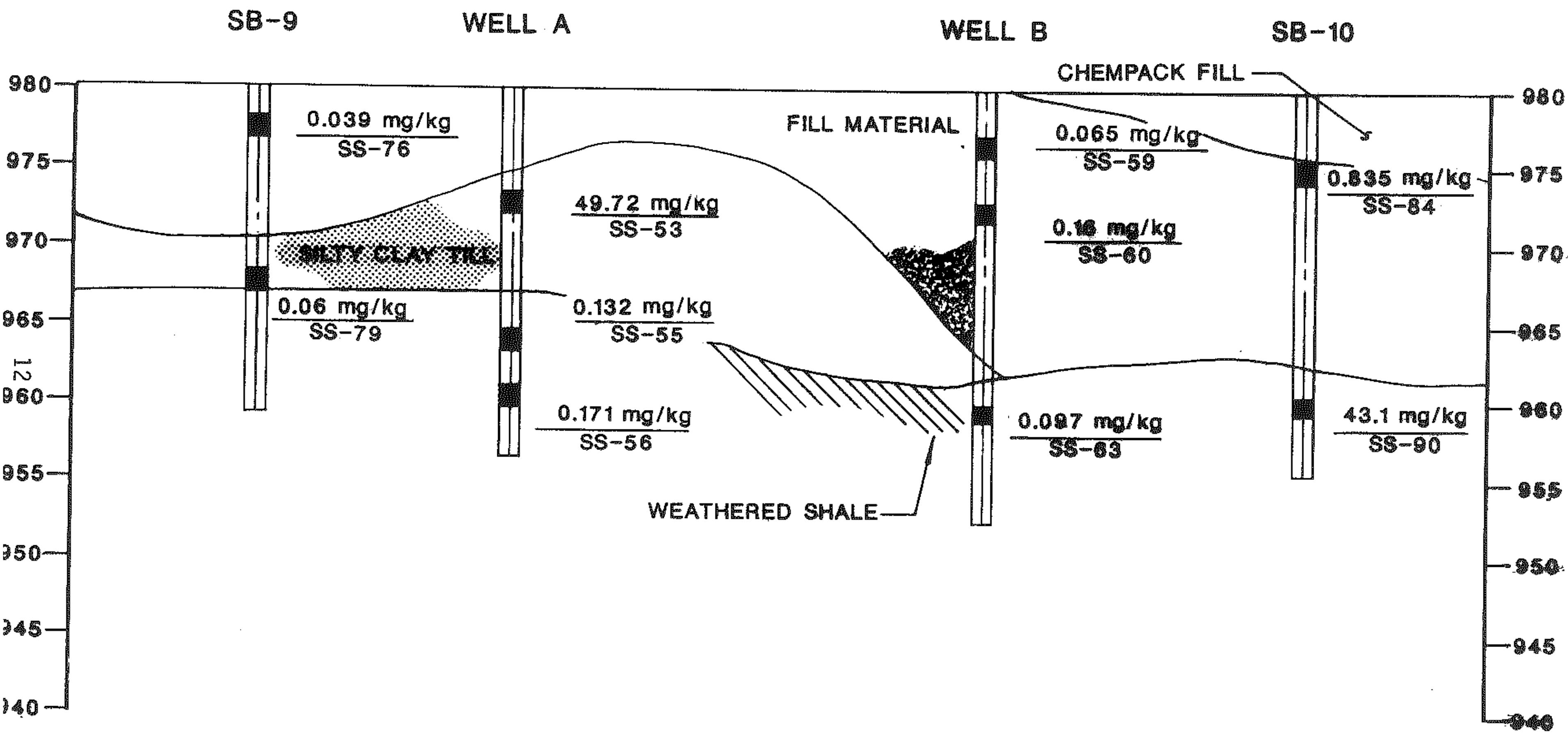

CROSS SECTION C-C

FIGURE 6

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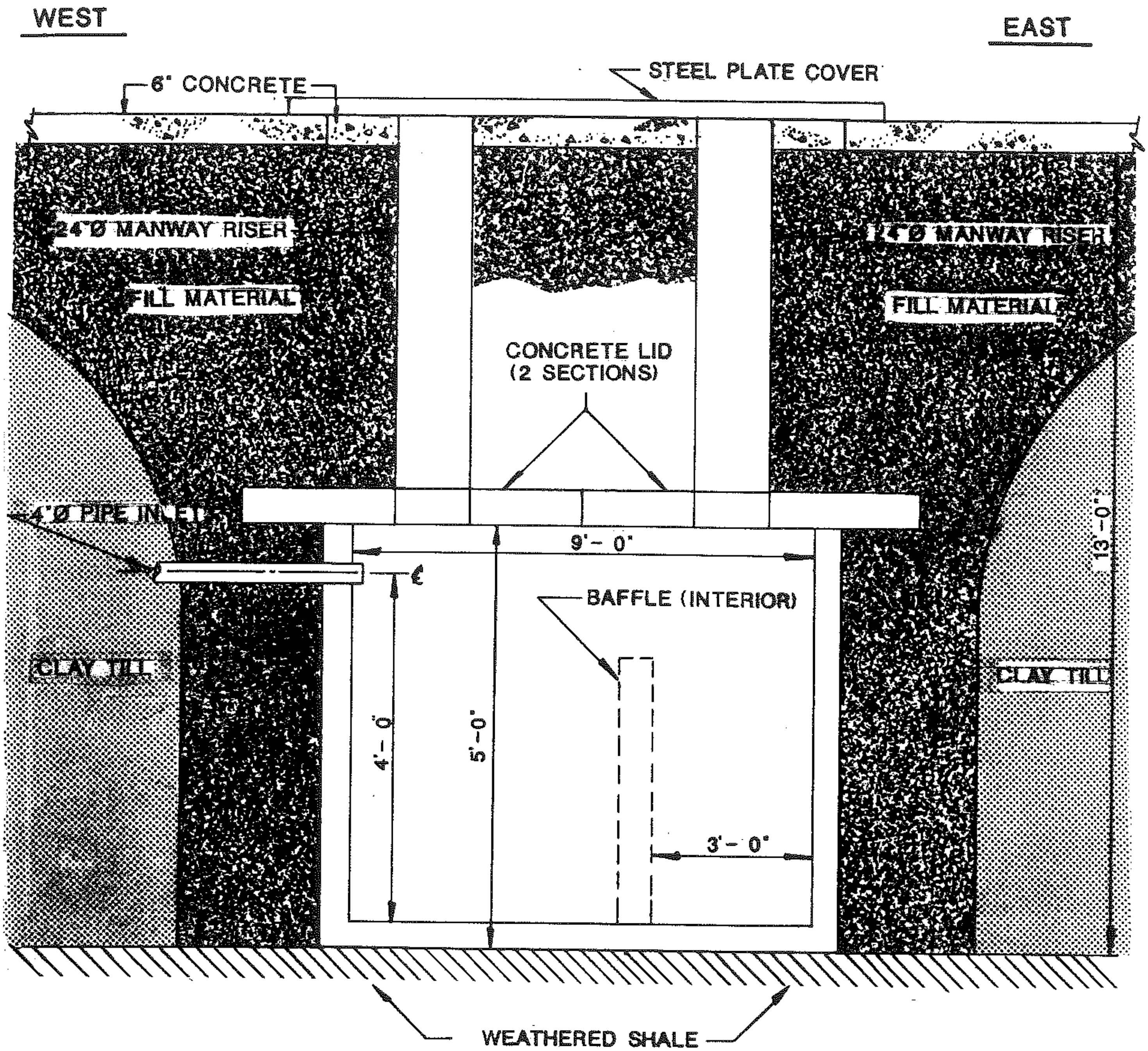


NOTE

1. DIMENSIONS SHOWN ARE APPROXIMATE.

UNDERGROUND CISTERN CROSS SECTION

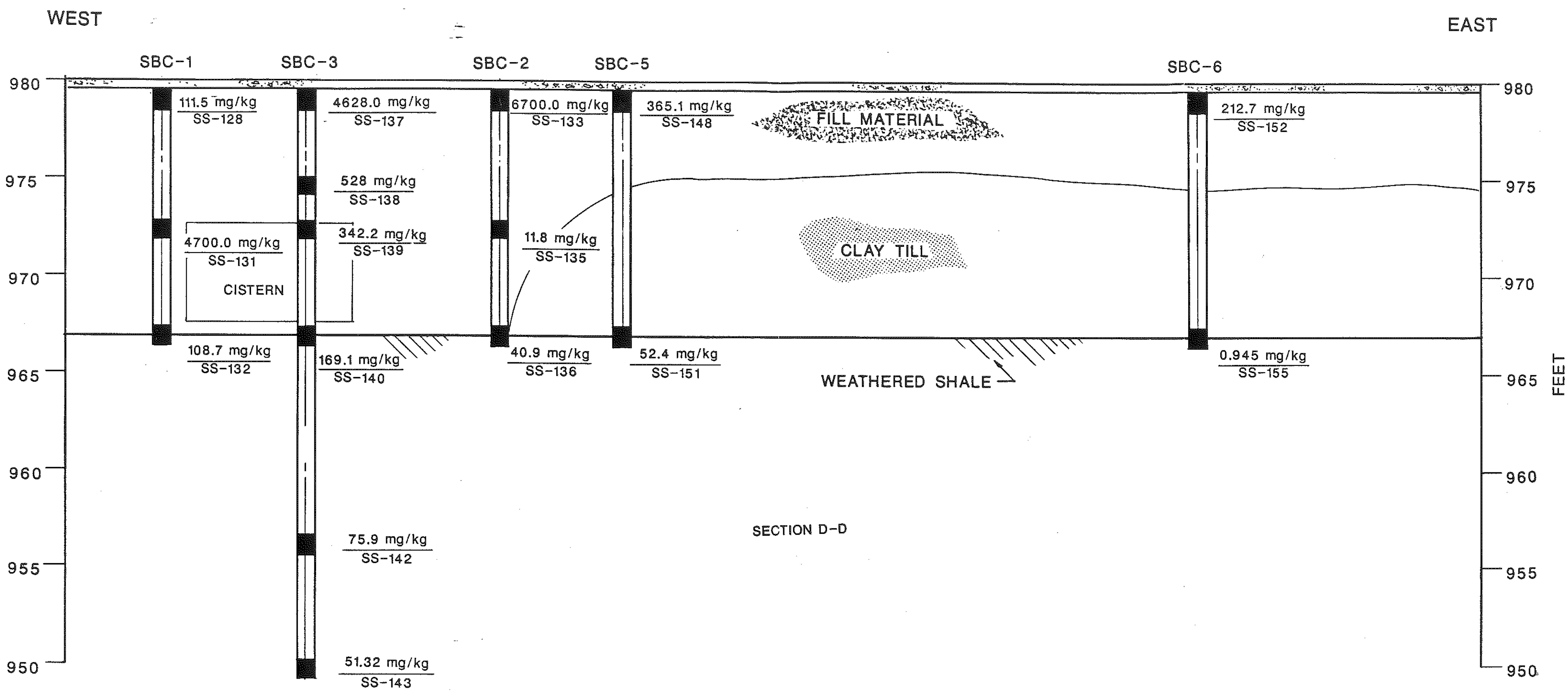
N.T.S

drains were sealed in 1982 and additional concrete was placed in each floor/trench drain in September 1986 under EA direction pursuant to EA's October 1985 "Closure Plan for the Underground Cistern."

The areal extent of VOC contamination in the soil around the cistern was shown in Figure 4. The vertical extent of VOCs is shown in Figure 8.

Perched water containing organic contaminants accumulates in the cistern and area around the cistern. The cistern was proposed as a dewatering point for perched water as described in EA's July 1989 "Review of Alternative Correction Actions" report. However, as required by OEPA and pursuant to the agreement reached with OEPA and USEPA at the November 7 meeting, a new dewatering system will be designed and constructed in close proximity to the cistern and the cistern closure will proceed. This system will be implemented as part of HCC's Corrective Action Plan.

FIGURE 8



CISTERN BORINGS
VOC CONCENTRATIONS
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BEDFORD, OHIO

III. CLOSURE PROCEDURES

General

The site investigations conducted at HCC identified soil contamination to the depth of groundwater at the solvent tank farm and the cistern. "Clean Closure" via excavation of contaminated soils and backfilling with clean soil was evaluated, but is not implementable because the area to be excavated is adjacent to and under HCC buildings and structures.

Partial excavation and backfilling with clean soil in the solvent tank and around the cistern was evaluated in lieu of removal of all contaminated soil. Limits on the location and depth of excavation established for the tank farm and cistern area were based on safety considerations relating to potential undermining at facility structures and the need for extensive shoring. Safe excavation depths established for the tank farm and cistern were five feet and three feet, respectively. The total volume of soil excavation corresponding to these depths is approximately 2400 cubic yards.

The approximate average total VOC concentrations were calculated for the volume of soil excavated above these depths and for soils remaining in each of these areas. The upper five feet of soils in the tank farm contain an average of 15 mg/kg of VOCs or less than 15% of concentration in the underlying soil (5 feet to 17 feet deep) which contains an average of 95 mg/kg VOCs. Based on these concentrations, the total approximate mass of VOCs in the upper five feet of soil is 45 kg and in underlying soils, which would remain after excavation is 680 kg. Soils at the underground cistern have an average VOC concentration of 2200 mg/kg in the upper three feet and an approximate average of 500 mg/kg between 3 to 14.5 feet. Excavating the upper three feet of soil would remove the greatest concentration of contaminated soils, but the backfilled soil would be contaminated as contaminated perched water migrates toward the cistern.

Based on this evaluation, the solvent tank farm and cistern will be closed as a landfill pursuant to OAC 3745-66-97(B). Specific closure procedures for each unit are described in the following sections.

Solvent Tank Farm

The tank farm closure will involve the following:

1. Removing the existing sumps and backfilling the holes with concrete.

2. Removing the existing earthen dike.

3. Placing a concrete cap over the contaminated soil in and around the tank farm.

4. Installing drainage piping beneath the cap.

5. Constructing secondary containment and drainage structures on a portion of the cap to accommodate a new hazardous materials storage tank farm.

A concrete cap will be placed over the contaminated soil in and around the tank farm to eliminate infiltration and potential contact with contaminated soil, and minimize the generation of perched water.

Figure 9 shows the area to be capped, and drawings 2 and 3 present the construction details. The cap will be constructed in three phases in order to continue to use the hazardous materials storage tanks throughout the project. Phase 1 will involve capping an area north and adjacent to the existing tank farm, and capping the east part of the solvent tank farm that was previously used to store hazardous wastes. The subsequent phases will involve extending the cap from the Phase 1 area to the south near the process building as shown on Figure 9.

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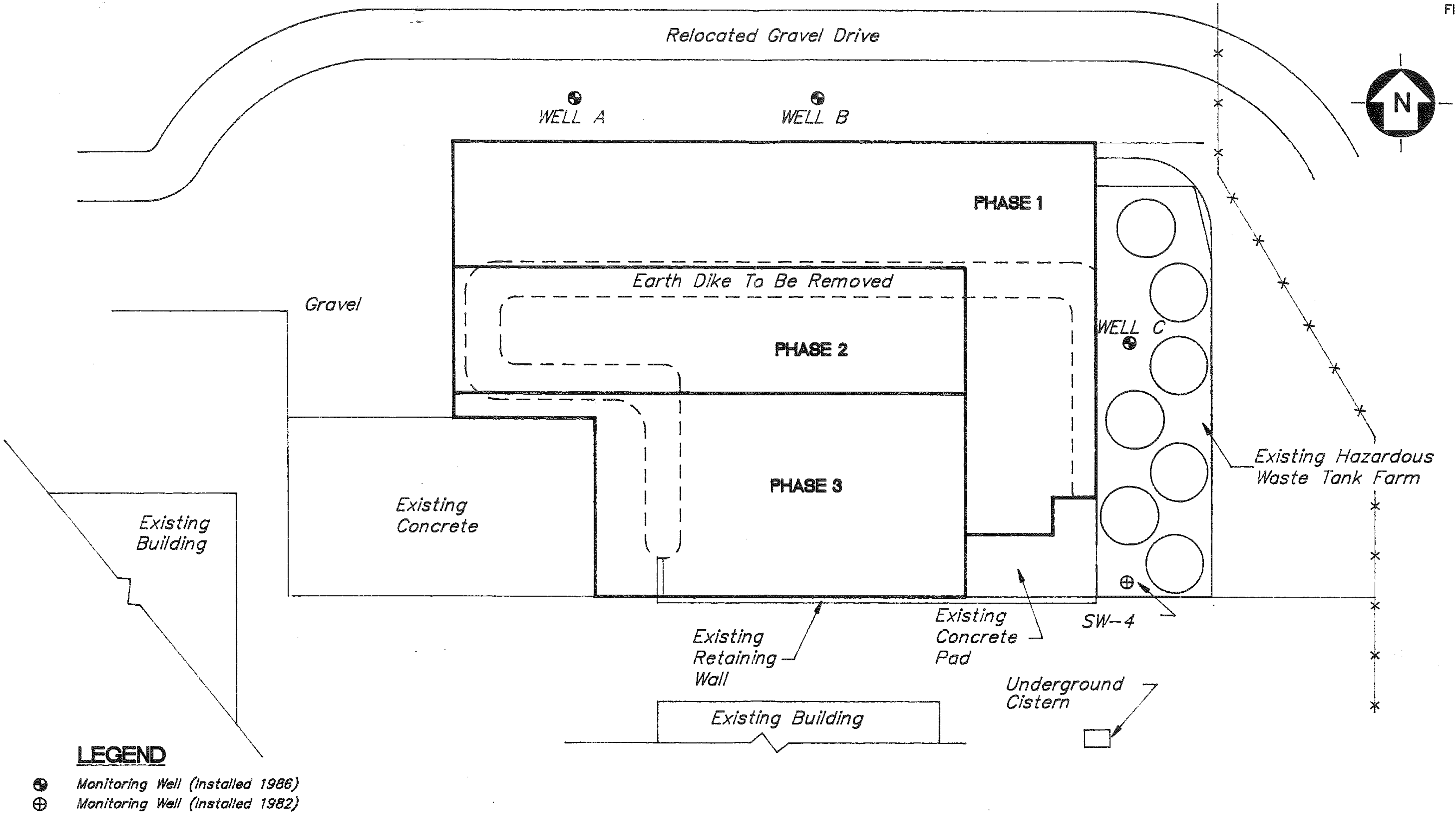
FIGURE 9



NOTE

Storage Tanks In Solvent Tank Farm Not Shown For Clarity

SK495-1F

CONCRETE CAP PHASES

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The Phase 1 cap area covers approximately 10,000 ft^2. The subgrade will be cut/filled to elevations as shown and compacted in any soft or loose areas using a suitable roller. Four-inch PVC perforated piping will be embedded in a layer of porous granular fill beneath and along the east-west length of the cap to collect perched water and to prevent frost heaving of the concrete cap. The perforated underdrain will run to concrete collection sump as shown. The liquid that accumulates in the sump will be pumped to an available hazardous waste storage tank, analyzed for VOCs (USEPA test method 8240) and disposed of accordingly. If the liquid is hazardous, it will be transported off-site in tanker trucks to a permitted TSD facility, or treated on-site. Non-hazardous liquids meeting NPDES permit limits will be discharged to outfall 001. Non-hazardous liquids exceeding permit limits would either be treated or disposed of off-site.

The porous granular sub-base will be compacted to the final elevations shown. Gravel existing in the tank farm can be used for this purpose, and any additional material will be imported.

The concrete cap will be 1 ft - 2 in thick, 4000 psi (at 28 days), and reinforced to ASTM A615 Grade 40 minimum standards. The permeability of the cap will be less than 10^{-7} cm/sec. The cap was designed to support the proposed hazardous materials storage tank farm and to meet the following requirements per OAC 3745-57-10:

(1) Provide long-term minimization of migration of liquids through the closed area.

(2) Function with minimum maintenance.

(3) Promote drainage.

(4) Accommodate settling and subsidence so that the cover's integrity is maintained; and

(5) Have a permeability less than or equal to the permeability of natural subsoils present.

A one-foot high concrete curb will be installed at the perimeter of the cap to provide secondary containment for the hazardous materials tank farm. Internal trenches covered with galvanized steel grating will be installed to collect precipitation. The liquid that accumulates in the internal sumps connected to the trenches will be pumped to a storage tank and analyzed for VOCs (USEPA test method 8240). If analyses indicate the liquid is non-hazardous, the liquid will be discharged to the existing outfall if it meets the NPDES permit limits. If the liquid is hazardous or exceeds the permit limits, then it will be pumped to a tanker and transported off-site to a permitted TSD facility, or processed on-site.

The equipment and labor associated with the cap installation are specified under the cost estimates in Section V of this report.

The tanks in the existing farm will be moved to the completed Phase 1 cap area before Phase 2 work begins. All piping and ancillary equipment associated with the new hazardous materials tank storage must be in place to move the tanks. Phase 2 work will begin after all the tanks have been moved.

Prior to removing the existing sumps, any perched water ponded in these areas will be pumped to one of HCC's permitted storage tanks or a tank trailer, analyzed for VOCs using USEPA SW-846 test method 8240 and either processed on-site or transported off-site to a permitted TSD facility. The two sumps will then be removed and the holes will be filled with concrete.

The earthern dike surrounding the tank farm will be removed and stockpiled on a polyethylene liner and covered with polyethylene north of the existing gravel roadway. The perimeter of the liner will be bermed to contain any precipitation. Four composite soil samples will be taken from the stockpiled material, analyzed for VOCs (USEPA test method 8240) and the soil will be disposed of accordingly. If the analytical results indicate that the material is not hazardous then it may be used on-site for fill. If the material is hazardous, it will be transported off-site to a permitted TSD facility.

The Phase 2 area cap covers approximately 6,000 ft^2. The stepwise construction procedures are identical to those cited above. The internal collection trench will be installed along the northern part of the cap. All liquids accumulating in the trench sump will be handled in the manner prescribed under Phase 1. The area will be bermed for secondary containment to accommodate hazardous materials storage tanks.

Phase 3 will involve capping the remaining area of contaminated soil area in and around the existing tank farm where no concrete currently exists. This part of the cap will cover approximately 6,600 ft^2. The concrete cap construction procedures are identical to those stated previously. The Phase 3 cap will incorporate a collection trench and perforated drainage piping as shown. All liquids accumulating in the trench sump and drainage sump will be handled in the manner prescribed for Phase 1. Currently, there are no plans to place tanks on this part of the cap, thereby eliminating the need to extend the secondary containment structures. The area will serve as an access way to the proposed tank farms and existing processing areas.

Groundwater monitoring and leachate management are discussed under Section IV, Post-Closure Care. Gas collection and control does not apply to the project.

<u>Underground Cistern</u>

The work that has been completed in accordance with EA's October 1985 "Closure Plan for Underground Cistern", includes the following:

1. Cistern liquid sampling and analysis.

2. Cistern sediment sampling and analysis.

3. Soil boring, sample collection and analysis around the cistern.

4. Liquid and sediment removal from the cistern.

5. Concrete placement in each floor/trench drain connected to the cistern.

6. Pressure-washing the inside of the cistern.

Appendix D presents the analytical results for all liquid, sediment and soil samples taken in and around the cistern. The water in the cistern was found to contain VOCs and low levels of barium, chromium and mercury. Both VOCs and varying levels of heavy metals were found in the sediment, but the sediment was not EP toxic.

The proposed closure procedures involve plugging the inlet line with cement, backfilling the tank with clean imported sand and capping the manways with one foot thick concrete.

Prior to backfilling, any liquid in the cistern will be pumped out to drums, analyzed for VOCs (USEPA test method 8240) and disposed of accordingly. If hazardous, the liquid will be processed on-site or hauled off-site. If non-hazardous and meeting NPDES limits, then the liquid will be discharged to the existing outfall.

The existing concrete pad that covers the contaminated soil area will prevent surface infiltration. The corrective action plan currently being prepared pursuant to the USEPA Consent Agreement and Final Order (Docket Number V-W85-R-014) will include remedial plans for collection and disposal of perched water.

Personnel Safety

The Health and Safety Plan (HASP) presented in Appendix E will be implemented during specific closure activities. This HASP presents hazard evaluation, responsibilities, work zones, site entry procedures, personnel protection levels, decontamination procedures and air quality monitoring and an emergency contingency plan.

In general, the personnel protection level for this closure plan is Level D. Plugging the inlet pipe to the underground cistern will require Level B protection. Background air monitoring will be conducted initially and throughout the project to determine if the protection level should be upgraded. Air quality will be monitored hourly for organic vapors downwind of the daily activities using organic vapor analyzer (OVA). If the total level exceeds 25 ppm, then personnel will be notified of a level protection upgrade and outfitted accordingly. Specific procedures are listed in the HASP.

Decontamination

Decontamination procedures for equipment and personal protective clothing are detailed in Section VII of the HASP. The designated contaminant reduction zone shown in Figure E-1 of the HASP will be used for decontaminating equipment.

Earth moving equipment contacting contaminated soil in the tank farm will be steam cleaned or detergent washed on the east concrete pad. Approximately 500 gallons of decontamination residues will be generated. Washwater will be collected in the existing catch basin, pumped to a storage tank, analyzed for VOCs (EPA test method 8240) and disposed of accordingly. If the liquid is hazardous, it will be transported off-site in tanker trucks to a permitted TSD facility, or treated on-site. Non-hazardous liquids meeting NPDES permit limits will be discharged to outfall 001. Non-hazardous liquids exceeding permit limits would either be treated or disposed of off-site.

Security

The working area of the facility is completely enclosed within a seven-foot high, chain link fence topped by three strands of barbed wire. The fence has four gates; one located at the northeast corner of the facility; one on the southeast driveway; one on the driveway in the middle of the facility, and the other on the southwest driveway.

Employees are not required to present identification for entry to the facility. Visitors and contractors entering the plant are required to sign a log sheet.

Signs which are legible from a distance of 25 feet are posted at all fence gates and several fence locations around the facility. These signs are visible from all angles of approach and bear the legend "Danger - Unauthorized Personnel Keep Out".

Active construction areas will be sectioned off with posted warning signs to deter access of personnel not involved with the closure.

Survey Plat

No later than the submission of the certification of closure of each hazardous waste disposal unit, HCC will submit to the local zoning authority and OEPA a survey plat indicating the location and dimensions of the solvent tank farm and underground cistern area with respect to permanently surveyed benchmarks. The plat will be prepared and certified by a professional land surveyor, and will contain a note stating HCC's obligation to restrict disturbance of these areas in accordance with the applicable rules in OAC 3745-66.

Closure Certification

Pursuant to OAC 3745-66-15 and 3745-50-42, within sixty (60) days of the cistern closure and each phase of the solvent tank farm closure, HCC will submit to the Ohio EPA Director a certification that the hazardous waste management units have been closed in accordance with the specifications in the approved closure plan. The certification will be signed by an independent registered professional engineer. HCC documentation supporting the independent registered professional engineer's certification will be furnished to the Director upon request. The engineer will make routine inspections at the facility during closure activities to support the certification.

Closure Schedule

Figure 10 presents the closure schedule for the tank farm and underground cistern. All closure activities can be completed in 180 days, weather permitting, upon final approval from the OEPA director. However, relocating the hazardous materials storage tanks, piping and ancillary equipment will create a lag between Phases 1 and 2 that will extend the project completion time beyond 180 days. The work should be completed in late 1990. If an extension is needed, HCC will submit a formal request to the OEPA under provisions stated in OAC 3745-66-13.

CLOSURE SCHEDULE

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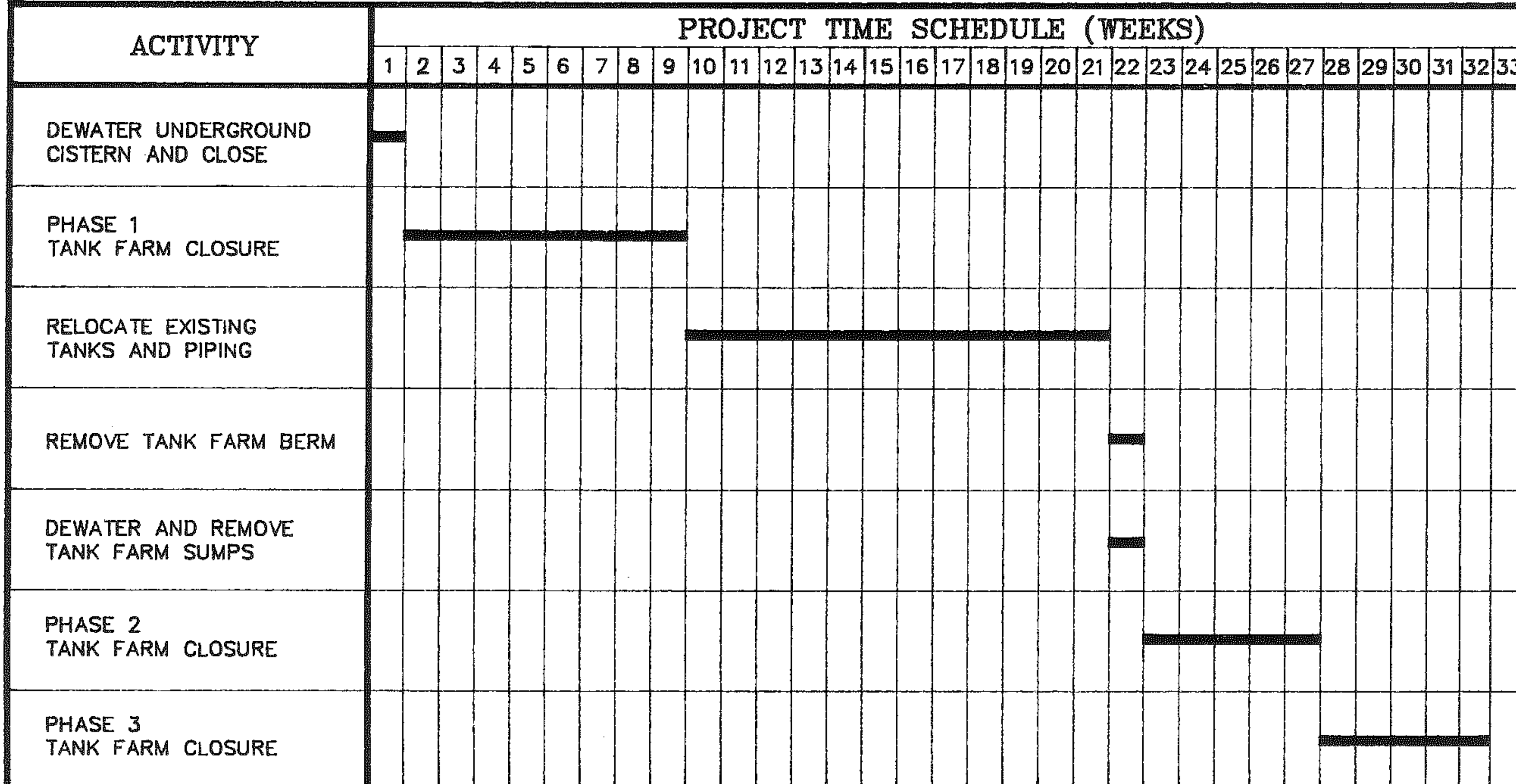


NOTE— Each Tank Farm Closure Phase Includes Excavating Gravel, Laying Drainage Pipe, Preparing Base, Installing Concrete Cap, Trenches, Berms And Grating.

SK495–1H

FIGURE 10

IV. POST-CLOSURE CARE

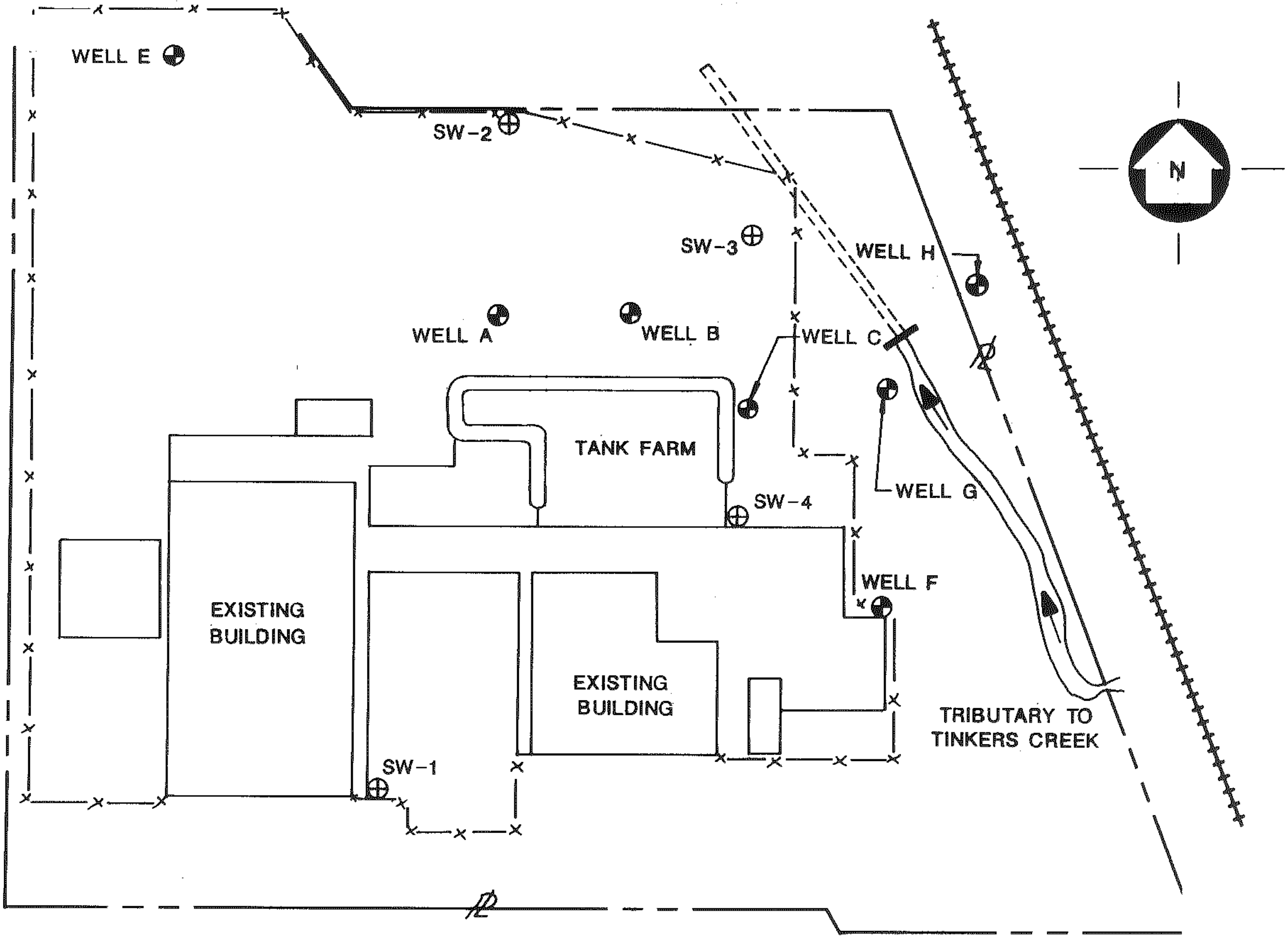
Groundwater Monitoring

HCC has a groundwater monitoring system which consists of ten monitoring wells in downgradient locations relative to the site. An upgradient monitoring well, SW-1 provides background monitoring data. The present number and placement of monitoring wells is sufficient for post-closure monitoring of the solvent tank farm and cistern because each unit has three or more downgradient monitoring wells in the uppermost aquifer and because background well, SW-1 is upgradient of both units and is far enough away to preclude it being contaminated by either unit.

Figure 11 shows all groundwater monitoring well locations. The monitoring wells that will be sampled during post-closure care include SW-1, SW-2, SW-3, SW-4, F and G. The SW-1 well will represent upgradient groundwater quality entering the site. The other wells will monitor the extent of VOC contamination previously identified during the site investigation. All wells will be sampled twice per year and analyzed for VOC (USEPA test method 8240) compounds previously identified in groundwater at the site. The sampling protocols will follow those specified in EA's Quality Assurance Program Plan implemented during the 1986 and 1988 site investigation.

Soil Sampling

Soil characteristics were documented as part of EA's previous site investigations. Since the contaminated soil will remain in place following closure and the concrete cap will minimize the potential for contaminant migration by preventing infiltration, continued soil monitoring activities are not proposed. The cap should also eliminate the presence and generation of perched water in the tank farm area, thereby reducing containment migration.



MONITORING WELL (INSTALLED IN 1986 AND 1988)

MONITORING WELL (INSTALLED IN 1982).

WELL LOCATIONS

SCALE 1"= 100'

FIGURE 11

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Leachate Monitoring

The drainage structures to be installed beneath the concrete cap in the tank farm area may collect perched water in the area. The perched water collected in the drainage sumps will be pumped to an available storage tank and analyzed for VOCs on an as needed basis. It is difficult to estimate the quantity that will be collected, but generation rates should decrease over time since the source (surface infiltration) will be eliminated by the concrete cap.

This perched water, if contaminated, will either be processed on-site or transported by tanker truck off-site to a permitted TSD facility. HCC will be responsible for maintaining a record of the quantity of perched water collected, all analytical results and the disposition.

Sampling and analysis of the perched water collected around the underground cistern will be detailed in the correction action plan, which is currently being prepared pursuant to the USEPA CAFO.

Inspections and Maintenance

HCC will be responsible for conducting post-closure inspections. The routine inspections will include checking the integrity of the cap in the tank farm semi-annually and monitoring for accumulated liquids in the drainage and trench sumps daily while the plant is in operation. Any repairs to the cap will be made immediately.

The groundwater monitoring wells will be inspected semi-annually by HCC for physical damage and repaired accordingly. The security system (fence, warning signs and gates) will be checked monthly for physical damage, and repaired accordingly.

The frequency of monitoring and maintenance activities may be altered if the use of the cap following closure changes. HCC reserves the right to modify this schedule, as well as any parts of the closure or post-closure plan, under provisions of OAC 3745-66-12(C) and 3745-66-18(D).

Post-Closure Notices

No later than sixty days after certification of closure of each hazardous waste management unit, HCC will submit to the local zoning authority, and to the OEPA director, a record of the type, location, and quantity of hazardous contaminated solid within each management unit.

Within sixty days of certification of closure of the cistern and within sixty days of certification of closure of the tank farm, HCC will:

(1) Record, in accordance with state law, a notation on the deed to the facility property, or on some other instrument which is normally examined during title search, that will in perpetuity notify a potential purchaser of the property that:

  (a) The land has been used to manage hazardous wastes;

  (b) Its use is restricted under OAC 3745-66-10 to 3745-66-20; and

  (c) The survey plat and record of the type, location and quantity of hazardous waste within each unit required by this rule and OAC 3745-66-16 have been filed with the local zoning authority and with the OEPA director.

(2) Submit a certification, signed by HCC, that they have recorded the notation specified above including a copy of the document in which the notation has been placed, to the OEPA director.

If HCC or any subsequent owner or operator of the land upon which a hazardous waste unit is located wishes to remove the contaminated solid, a request to modify the post closure plan must be made in accordance with applicable requirements in the OAC.

Post-Closure Care Certification

Pursuant to OAC 3745-66-20 and 3745-50-42, no later than sixty days after completion of the established post-closure care period, HCC will submit to the OEPA director, by registered mail, a certification that the post-closure care period for the hazardous waste management unit was performed in accordance with the specifications in the approved post-closure plan. The certification will be signed by the owner or operator and in independent registered professional engineer. Documentation supporting the independent registered professional engineer's certification will be furnished to the OEPA Director upon request.

V. COST ESTIMATES

The closure and post-closure care cost estimates are presented in Tables 2 and 3, respectively. The estimated closure cost is $304,000 and the estimated post-closure care cost is $198,000.

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TABLE 2

CLOSURE COST ESTIMATE

	Item	Cost Estimate[a]
1.	Sub-base Preparation Excavate 450 yd^3 gravel	\$1,000
2.	Gravel Base Fill Spread & Compact 23,000 ft^2	6,000
3.	Drainage Piping & Filter Fabric 400 feet 4"-diameter PVC 1500 ft^2 Geotech Fabric	2,000
4.	Concrete Cap 1,000 yd^3 1'-2" Slab Reinforced, 4,000 psi	250,000
5.	Trench Grating 1,000 ft^2 Standard Steel 3#/ft^2	5,000
6.	Underground Cistern Dewater, Backfill W/Sand & Concrete Cap	1,000
7.	Sampling and Laboratory Analyses	4,000
8.	Engineering Supervision and Certification	7,000 (b)
9.	SUBTOTAL	\$276,000
10.	Contingency & Administration @ 10%	28,000
11.	TOTAL	\$304,000

NOTES:

(a) Includes labor and equipment.
(b) Includes labor, travel and expenses for three separate trips (each phase).

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BEDFORD, OHIO

TABLE 3

POST-CLOSURE CARE COST ESTIMATE[a]

	Item	Cost Estimate[a]
1.	Groundwater Sampling and Analysis	
	Sampling by HCC Personnel	$ 30,000
	Analysis by Contract Laboratory	120,000
2.	Inspections	
	Cap, Security System & Monitoring Wells by HCC	15,000
3.	Cap Maintenance	15,000
4.	SUBTOTAL	$180,000
5.	Contingency & Administration @ 10%	18,000
6.	TOTAL	$198,000

Note:

(a) Cost estimate for 30 years, present worth.

APPENDIX A*

HYDROGEOLOGY

Ref: "Site Investigation Report,
Revision Number 1", Eder Associates,
January 1989

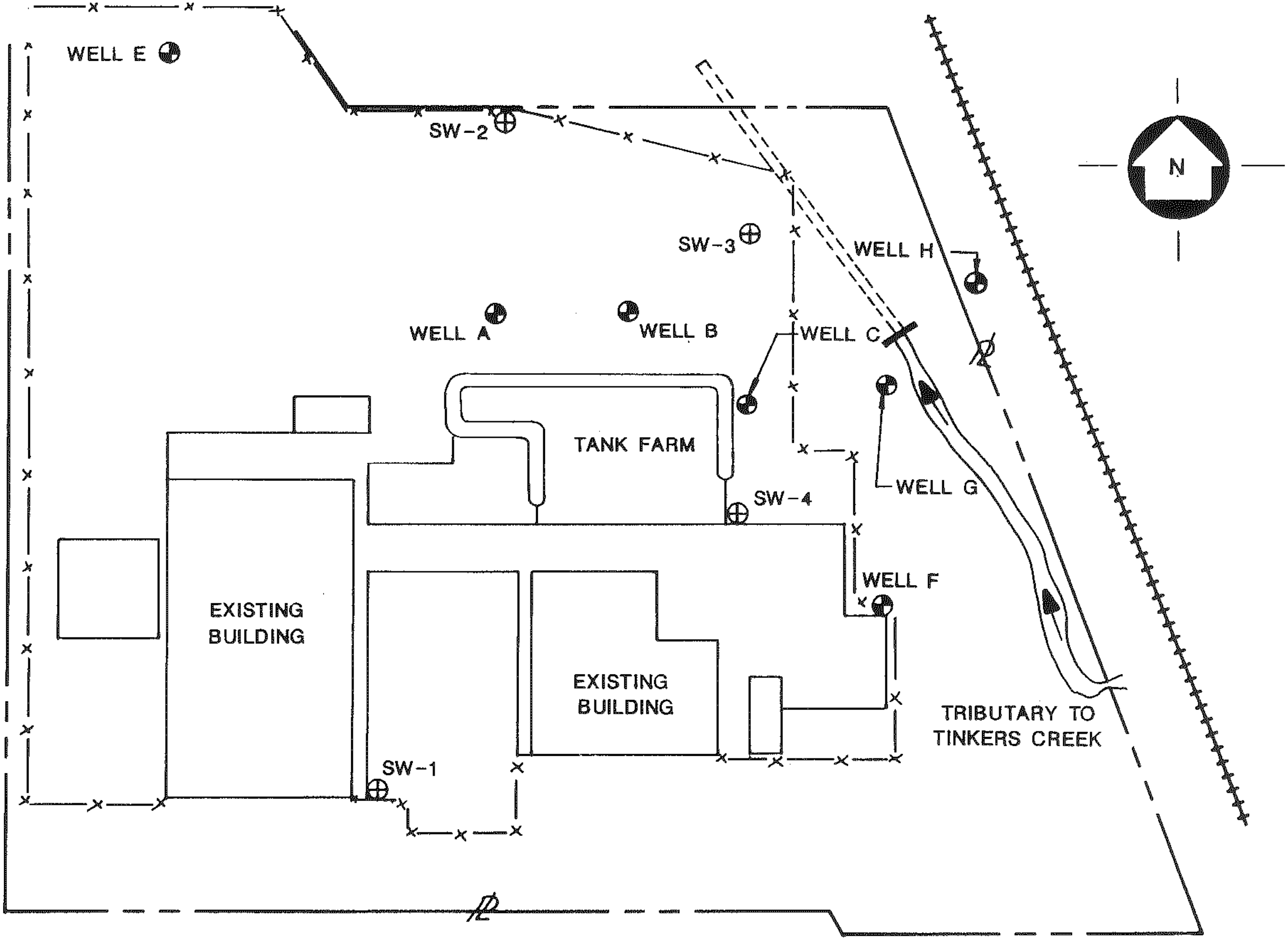
*Note: Appendices referenced in this Appendix are those found in the above referenced report and not included in this Closure Plan.

3.0 HYDROGEOLOGICAL CONDITIONS

Investigations conducted during April/May 1986, September/October 1986 and April 1988 included test borings and monitor well installations to define soil, subsoil, shallow geologic and groundwater conditions at the HCC site. A total of 63 soil borings plus seven monitor wells were installed during this period. Currently, there are a total of 11 monitor wells on site as shown on Figure 1. All monitor well and soil boring logs are presented in Appendix B. Four hydrogeological cross sections, designated as sections A-A', B-B', C-C' and D-D', are presented at the end of this section (Figures 5 through 9).

Most of the site is underlain by fill material ranging in thickness from one ft. to over 25 ft., and consisting of silty-sandy clay loam except in the "Chem-Pack" and Northwest fill areas where other types of fill are present as described in preceeding sections of this report. Underlying fill material is glacial till deposited during the Illinoisan stage of glacial advancement. It is a silty clay till which varies in thickness at the site. In some areas, the fill material overlies the shale bedrock (Meadville Shale). Grain size analysis tests performed on samples of the fill, till, and shale by Triggs and Associates, Inc. are presented in Appendix B.

A fractured and weathered zone characterizes the upper 25 ft. of shale. Numerous fractures are present which allow the circulation of shallow groundwater. Beneath this zone, the shale is more consolidated, less permeable and acts as a confining layer. This Meadville shale, which is the consolidated bedrock under the site, consists of alternating thin sandstone beds. It is medium to dark gray, fissile and arenaceous. The sandstone layers range in thickness from 1 to 10 inches. The Meadville shale has an average thickness of 75 feet, but varies from 35 feet to 90 feet south and west of the site (information obtained from records of well logs in Bedford Township). The Meadville shale is underlain by the Sharpsville sandstone which has



⊕ MONITORING WELL (INSTALLED IN 1986 AND 1988)

⊕ MONITORING WELL (INSTALLED IN 1982).

WELL LOCATIONS

SCALE 1" = 100'

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FIGURE 1

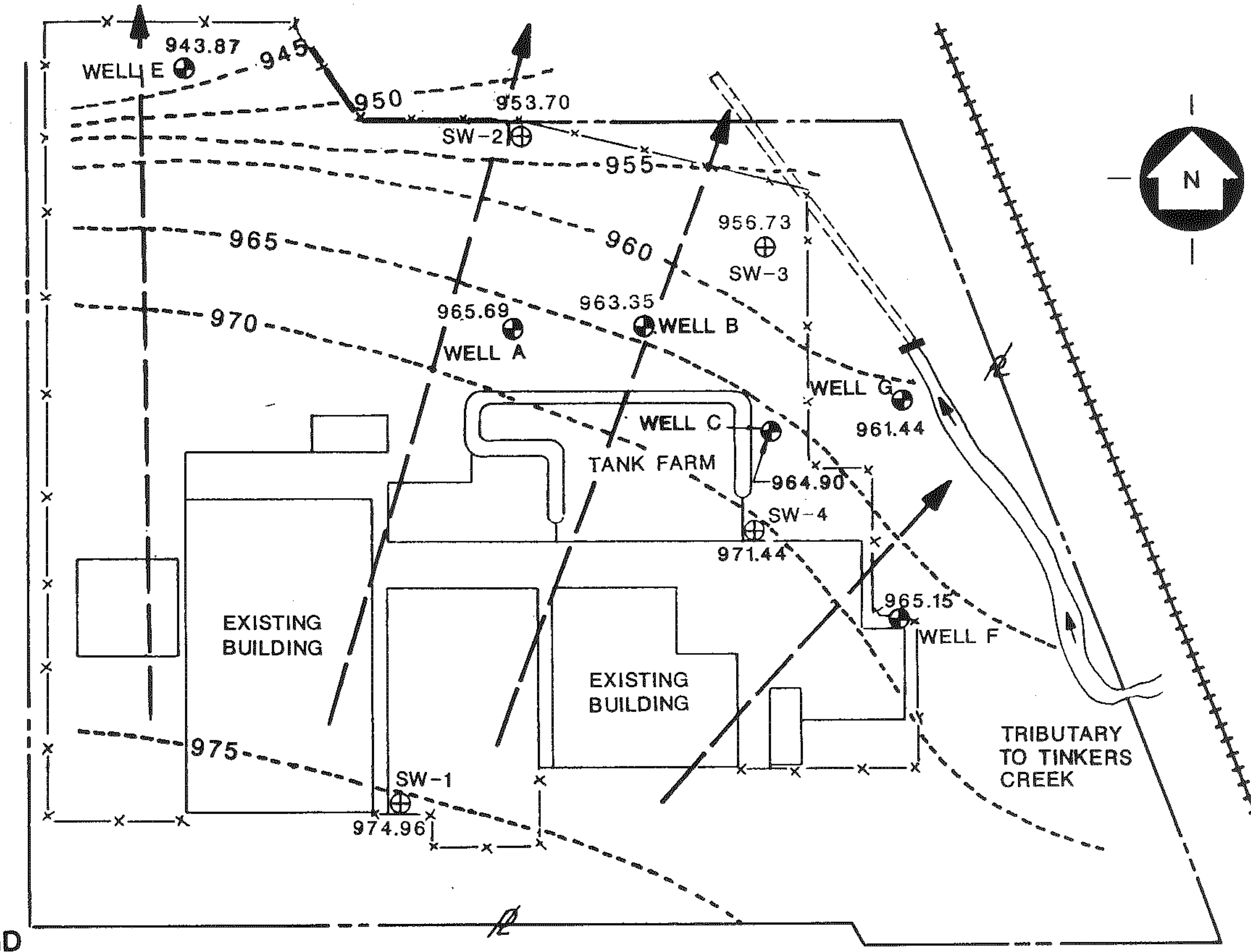
an average thickness of 45 feet. It consists of interbedded shales and sandstones. The sandstone layers are generally 1 to 14 inches thick and consist of hard, limy, gray-brown, fine grained calcareous beds. The interbedded blue shale is weak and fissile.

A small gulley borders the norther and eastern edges of the site where the surface topography drops sharply into a small intermittent tributary of Deerlick Run, Tinkers Creeek, the Cuyahoda River and, ultimately, Lake Erie. Unconsolidated glacial deposits pinch out in this gulley, which contains alluvial deposits consisting of interbedded silty clays, sandy clays and laminated silts with interbedded layers of organic clays and silts. These sediments lie directly on the shale bedrock which outcrops along the creek.

The shallow groundwater flow maps presented on Figures 2 and 3 were prepared using water level elevations of October 1986 and April 1988. Groundwater flow is shown schematically on Figure 4. Water level elevations are presented in Table 1.

The groundwater system has been identified at the site. Groundwater is confined in the weathered shale zone which is overlain by relatively impermeable silty clay fill and glacial till deposits and underlain by unweathered shale. Water levels in wells in the weathered shall stabilized an average of 10 ft. higher than the saturated zone tapped by the wells. The saturated weathered shale zone is underlain by gray shale which forms the lower confining layer.

A deep well was planned for the evaluation of the potential for vertical migration of contaminants into the shale bedrock. The deep well was drilled to a depth of 44 ft. and casing was installed to 34 ft. and the bottom of 10 ft. remained open. No groundwater was detected in the shale below the saturated fractured and weathered zone. The test well was left open to determine if any water would be produced, but, after one week, the test well remained dry. Based on this data, the shale underlying the site is relatively impermeable with little or no interconnection between fractures. Consequently,



LEGEND

- MONITORING WELL (INSTALLED 1986)
- MONITORING WELL (INSTALLED 1982)

[ELEVATIONS IN FEET]

(OCTOBER 1986)

GROUNDWATER FLOW PATTERN

FIGURE 2

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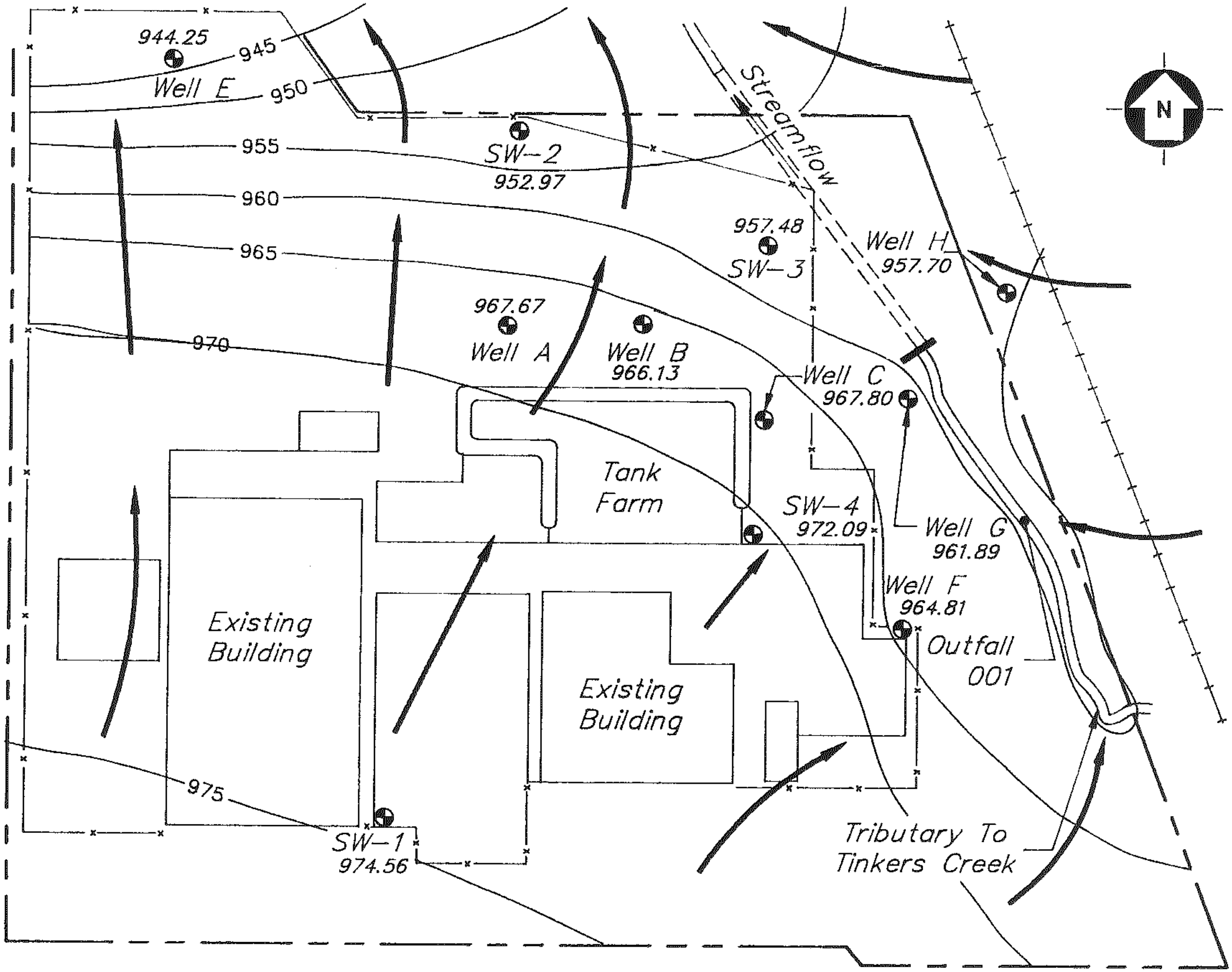

A-5

LEGEND

MONITORING WELL

FLOW DIRECTION

[ELEVATIONS IN FEET]

GROUNDWATER FLOW & CONTOUR MAP
(APRIL 1988)

HUKILL CHEMICAL CORP.
BEDFORD, OHIO

REF.# SK495–1C

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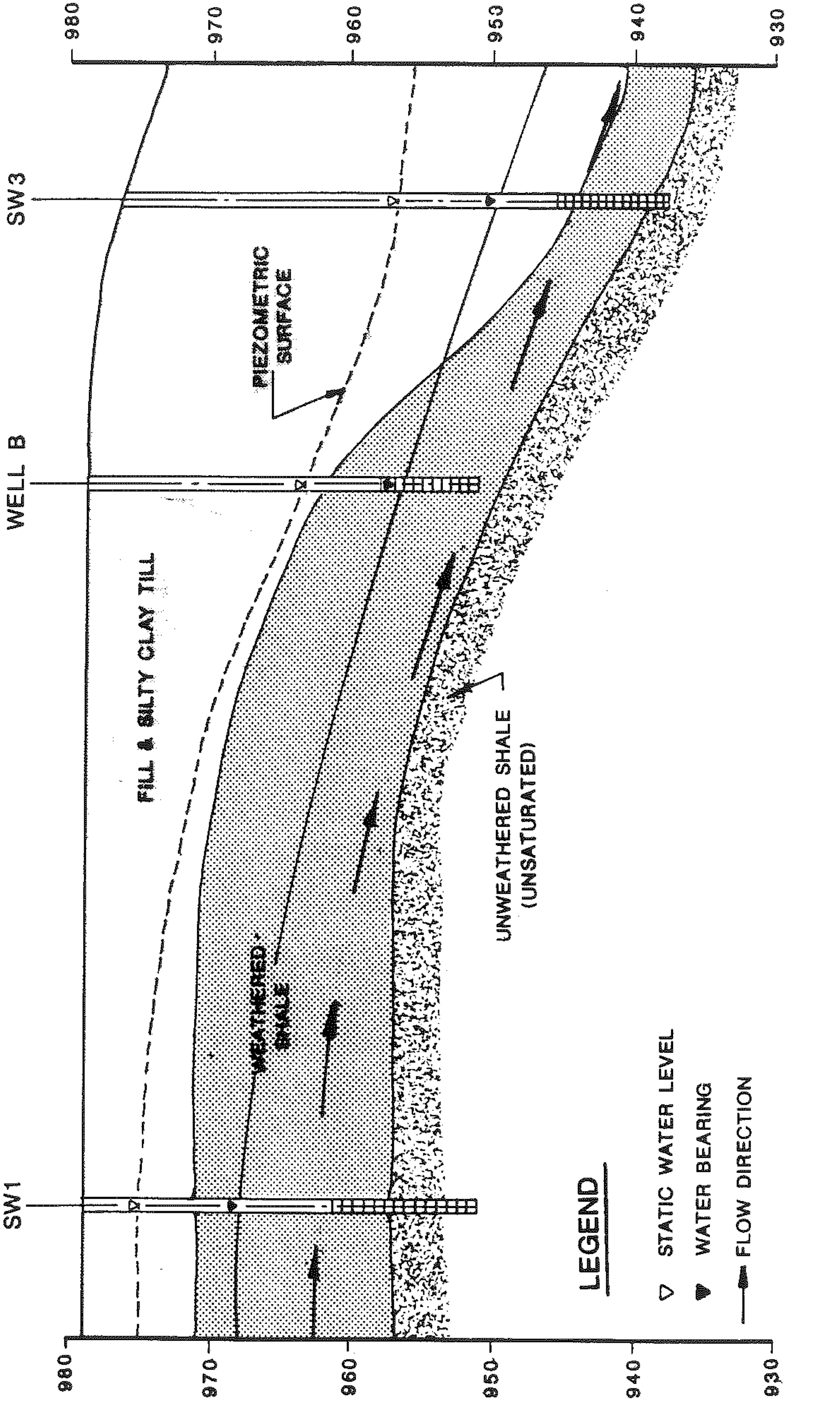
FIGURE 3

FIGURE 4



GROUNDWATER FLOW PATTERN

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 1

WATER LEVEL ELEVATIONS (ft)

Monitor Well	Date						
	September 1982	October 1982	May 1986	September 1986	October 1986	February 1987	April 1988
SW-1	974.65	975.09	974.06	974.96	--	(NA)	974.56
SW-2	952.76	953.00	952.85	--	953.70	953.85	952.97
SW-3	956.34	956.48	956.83	956.73	--	955.86	957.48
SW-4	969.23	970.86	972.29	971.79	--	971.21	972.09
A	(1)	(1)	967.24	965.69	--	966.17	967.67
B	(1)	(1)	964.55	963.35	--	963.72	966.13
C	(1)	(1)	966.60	964.90	--	965.77	967.80
E	(2)	--	--	--	943.87	944.22	944.25
F	(2)	--	--	--	965.15	969.12	964.81
G	(2)	--	--	--	961.44	961.07	961.89
H	(3)	--	--	--	--	--	957.70

Notes:

1. Wells A, B and C installed in April 1986
2. Wells E, F and G installed in September and October 1986
3. Well H installed in April 1988
4. (NA) not accessible

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downward migration of shallow groundwater is prevented by the shale and it does not enter the underlying Berea or Sharpsville Sandstone aquifers.

The site investigation results indicate that the groundwater found in the weathered shale under the site is confined to a narrow zone near the till/shale interface. The flow pattern in this zone appears to be lateral into the creek which forms the northern and eastern boundaries of the property.

As part of a groundwater quality assessment program at a neighboring site (Egbert Corporation, formerly S.K. Wellman Corporation), three deep and eight shallow wells were installed at depths ranging from 70 to 80 ft. and 10 to 30 ft. respectively. Egbert Corporation retained Woodward-Clyde Consultants to conduct a site investigation for closure of a surface impoundment constructed in 1956 as part of on-site industrial wastewater treatment. Wastewater treatment sludge (Hazardous Waste Code F006) was stored in the impoundment.

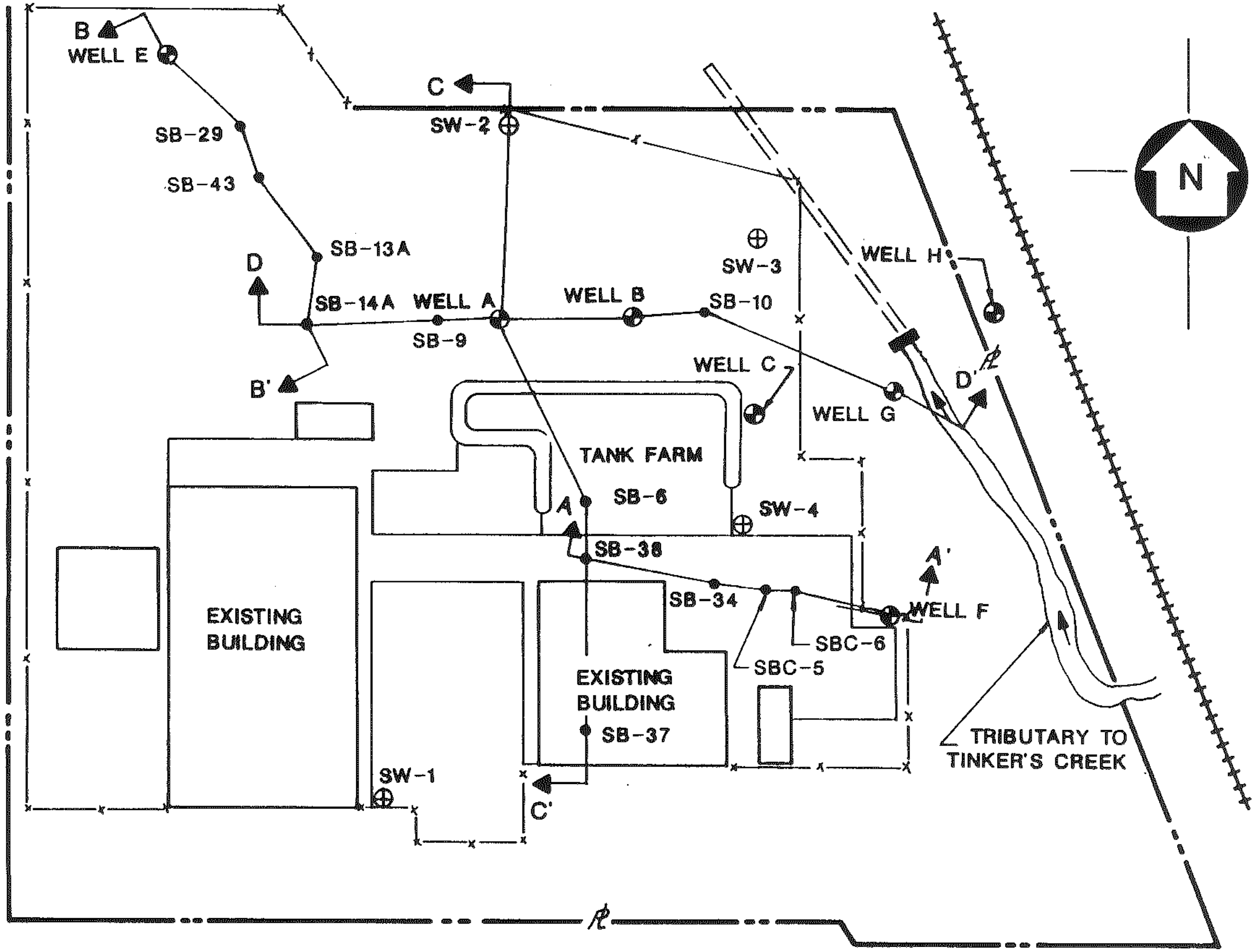
Results of Woodard-Clyde's site study entitled "Implementation of Egbert Corporation's Groundwater Quality Assessment Program" indicate that, although groundwater was found during air-rotary drilling at depths ranging from 62 to 72 ft., once the deep wells were bailed dry, they did not recover an appreciable amount of water for several months. Static water levels in the deep wells screened in the Meadville shale were on the average 29 feet lower than static water levels in the shallow water table wells screened in the weathered zone. This indicates that the underlying shale at the Hukill and Egbert sites is aerially extensive, virtually impermeable and effectively prevents local recharge of the underlying sandstone aquifers.

Groundwater flow at HCC is predominately to the north-northeast toward the alluvial deposits at the creek. Hydrologic gradients increase from 0.022 ft/ft in southern sections of the site to over 0.08 ft/ft in the northern section. The permeability of the confining soils have been measured and are very low. Silty till deposits were found to have a permeability of 2.8 EE-5 cm/sec, while clayey till samples ranged from 2.2 EE-8 to 8.6 EE-8 cm/sec. A sample from the weathered shale zone was found to have a permeability of 2.4 EE-8 cm.sec. Although the absolute permeability of the weathered shale sediments was found to be quite low in the laboratory, this unit is quite permeable overall due to its high incidence of fractures (secondary permeability).

The hydraulic conductivity of Wells A and B were measured using the slug "falling head" test method. Slug testing involves either injecting from a well (falling head) or withdrawing (rising head) a slug of water of known volume. The rate at which the water rises or falls is controlled by the information characteristics. Based on the results of the tests, with calculations performed according to prescribed methods, the permeability at Well B was estimated to be 4.23 EE-04 cm/sec or 1.2 ft/day. A slug test was also attempted at Well A, however before any water level measurements could be made, the slug of water had already recharged into the formation. Slug tests are only practical for lower permeability materials. Permeability at Well A is assumed to be quite high, since fracturing in the shall is much more pronounced than in Well B. Throughout the site, serveral borings were drilled through the weathered zone without intercepting a saturated zone. These "dry holes" notably SBW-16, SB-18, SB-28, SB-32, SB-35, SB-38 and the original location for Well F, which had to be installed in SB-46 indicates that considerable variations in permeability exist throughout the shallow groundwater zone (weathered shale).

Estimates of groundwater flow rate would be difficult to calculate accurately in the weathered shale zone. The material exhibits changes in hydrologic conductivity due to varying amounts of fracture in the shale. Groundwater flow at the site may be described as occurring between highly fractured zones and zones where there is less conductivity of this groundwater system is controlled by the number of cracks and fractures present. The groundwater follows these cracks and fractures downgradient to the creek.

Drilling conducted at the plant process building, inside the tank farm, and around the cistern revealed a layer of perched groundwater. This water was found in the sandy fill material around underground piping under the east process building of the plant. Perched water was found above impermeable clay till deposits at 2 to 3 ft. below the concrete floor. Water also is present at the surface in the gravel base of the tank farm. It appears that the perched water in the tank farm is connected to the perched water found under the building by sand backfilling around underground plant piping and beneath facility structures (i.e., footings and foundations).



LEGEND

- MONITORING WELL (INSTALLED 1986 AND 1988)
- MONITORING WELL (INSTALLED 1982)
- SOIL BORING (SB)

SCALE 1" = 100'

LOCATION OF CROSS SECTIONS

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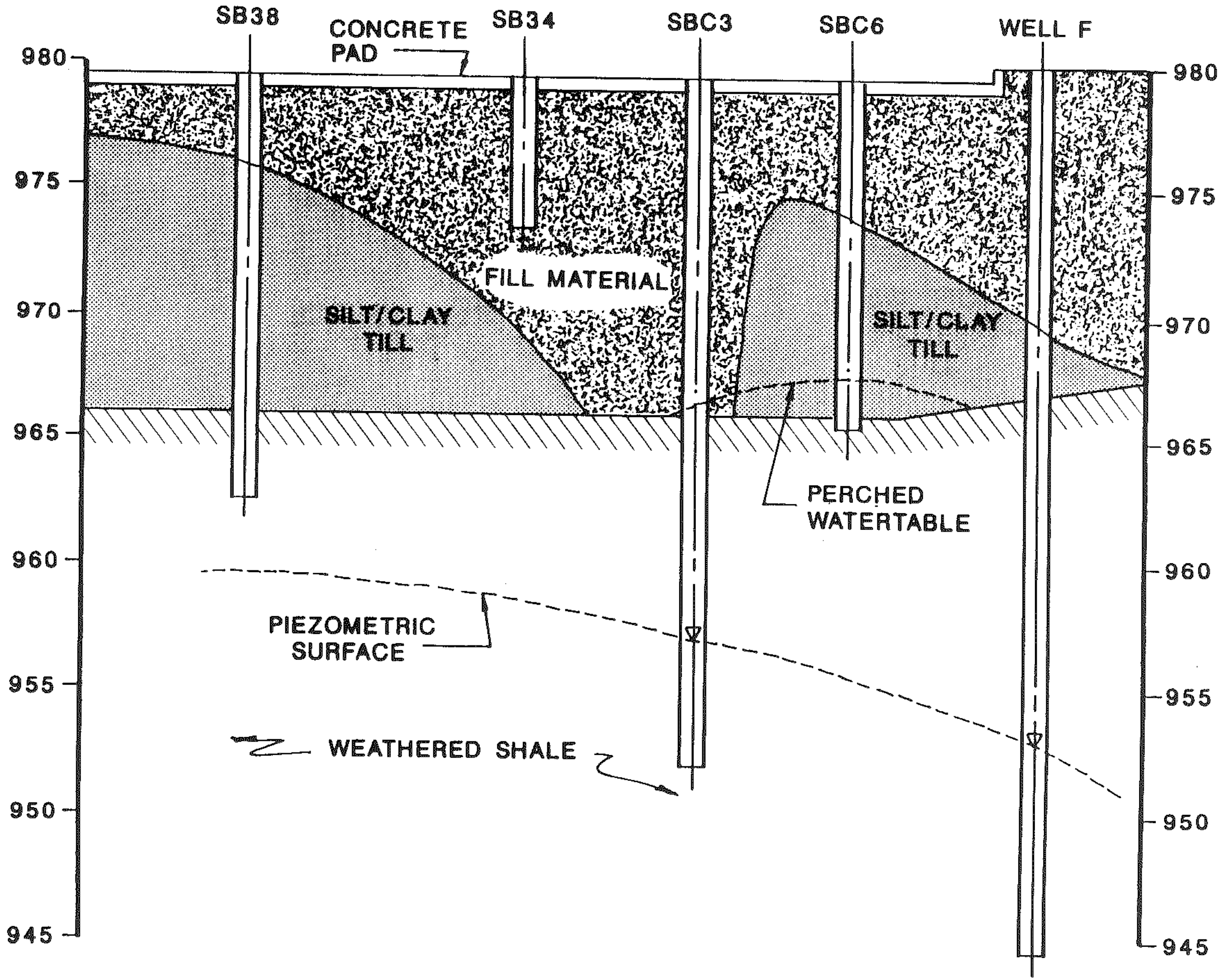
FIGURE 5



CROSS SECTION A-A

FIGURE 6

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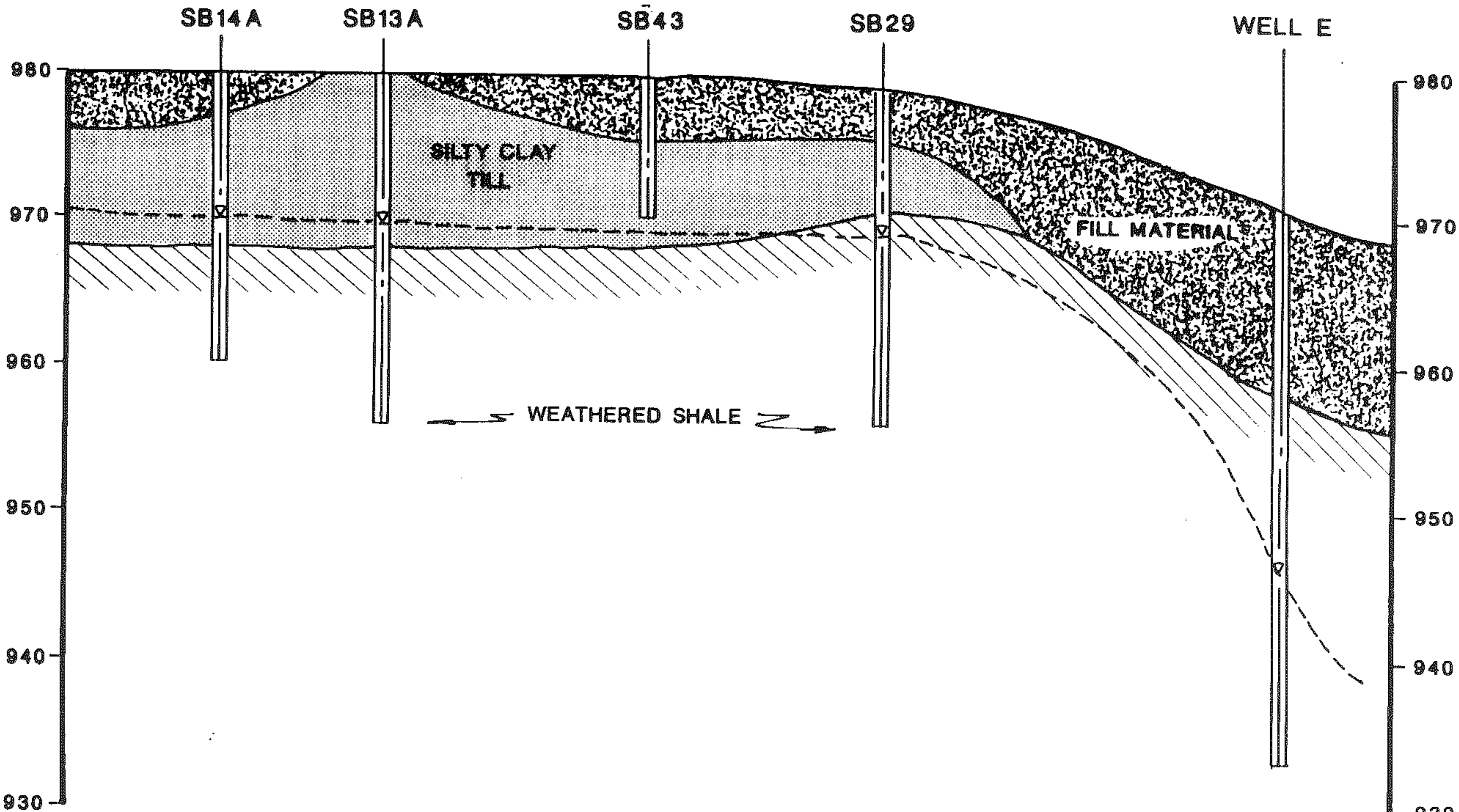
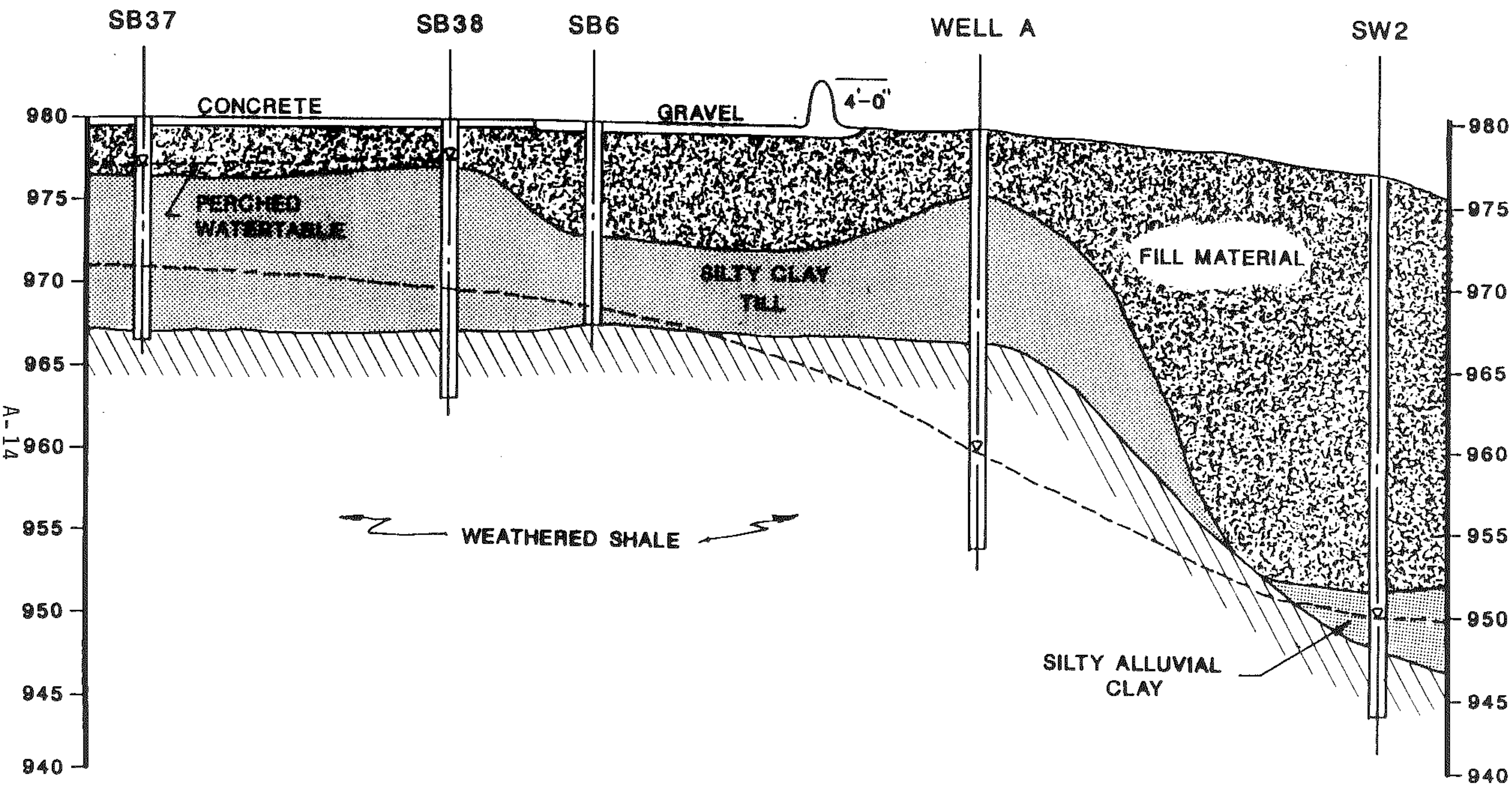
FIGURE 7



CROSS SECTION B-B



CROSS SECTION C–C

A-14

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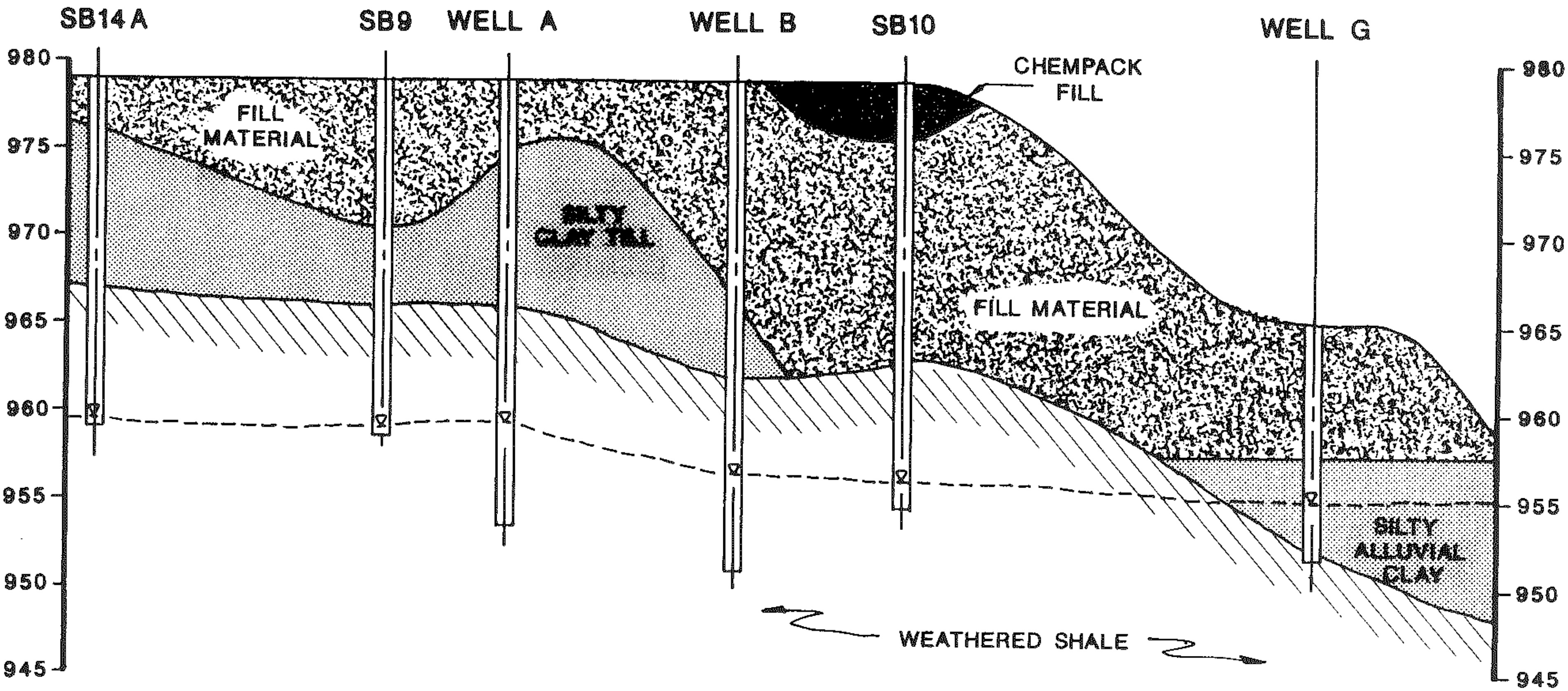
FIGURE 8



CROSS SECTION D-D

FIGURE 9

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APPENDIX B

GROUNDWATER MONITORING RESULTS

HUKILL CHEMICAL CORPORATION

BEDFORD, OHIO

TABLE 61

GROUNDWATER MONITORING RESULTS

ORGANIC ANALYSES

MAY 1986

Sample Location	SW-1	SW-2 (3)	SW-3	SW-4	A	B	B, Duplicate	B, Blank	C
Sample Number	GW-7	--	GW-5	GW-4	GW-1	GW-2	GW-2	GW-2	GW-3
Sample Date	5/17/86	--	5/17/86	5/16/86	5/16/86	5/16/86	5/16/86	5/16/86	5/16/86
Parameter (mg/l)									
Methylene Chloride	0.001 (J)	--	0.003 (J)	0.042	LD	440.0	490.0	0.010	1300.0
Acetone	0.014	--	0.020	0.047	LD	92.0	LD	0.056	LD
2-Butanone	LD	--	LD	0.023	LD	LD	LD	0.013	LD
Toluene	LD	--	LD	0.005	0.030	LD	LD	0.004 (J)	LD
1,1 Dichloroethane	LD	--	LD	0.016	0.006	LD	LD	LD	LD
Xylene	LD	--	LD	LD	0.030	LD	LD	0.002 (J)	LD
Ethyl Benzene	LD	--	LD	LD	0.005	LD	LD	LD	LD
4-Methyl-2-Pentanone	LD	--	LD	0.009 (J)	LD	LD	LD	LD	LD
Propane 2,2-Oxybis (Isopropyl Ether) (4)	LD	--	LD	0.080 (J)	LD	LD	LD	LD	LD
TOC	2.8	--	73.9	22.6	1.4	59.8	71.1	1.4	107.0
TOX	0.040	--	0.270	0.200	0.010	22.0	180.0	LD	120.0

NOTES:

1. LD indicates less than the detection limit.
2. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample refer to the laboratory reports in Appendix C.
3. No sample was collected for analyses because bailer could not be retrieved from well SW-2. Problem was rectified in September 1986 and sample was collected for analyses.
4. Propane 2,2' - oxybis (isopropyl ether) is not regulated as a hazardous substance.
5. (J) indicates compound identified and concentration estimated below the detection limit.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 62

GROUNDWATER MONITORING RESULTS
INORGANIC ANALYSES
MAY 1986

Sample Location	SW-1	SW-2(2)	SW-3	SW-4	A	B	B, Duplicate	B, Blank	C
Sample Number	GW-7	--	GW-5	GW-4	GW-1	GW-2	GW-2	GW-2	GW-3
Sample Date	5/17/86	--	5/17/86	5/16/86	5/16/86	5/16/86	5/16/86	5/16/86	5/16/86
Parameter (mg/l)									
Arsenic	LD	--	LD	LD	LD	LD	LD	LD	LD
Barium	LD	--	LD	0.210	LD	0.190	0.190	LD	0.100
Cadmium	LD	--	LD	LD	LD	LD	LD	LD	LD
Chromium	LD	--	LD	LD	LD	LD	LD	LD	LD
Lead	LD	--	LD	LD	LD	LD	LD	LD	LD
Mercury	LD	--	LD	LD	LD	LD	LD	LD	LD
Selenium (3)	LD	--	LD	LD	LD	LD	LD	LD	LD
Silver	LD	--	LD	LD	LD	LD	LD	LD	LD
pH	8.05	--	7.39	7.08	6.20	6.06	--	6.96	5.78
Conductivity-umohs/cm	3600	--	9250	4750	8750	6990	--	5.1	4700

NOTES:

1. LD indicates less than the detection limit. Detection limits are provided in the laboratory reports in Appendix C.
2. See Note 3, Table 60.
3. Spike sample recovery for selenium analysis was not within the control limits.
4. -- indicates parameter not analyzed.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 63

GROUNDWATER MONITORING RESULTS
ORGANIC ANALYSES
SEPTEMBER/OCTOBER 1986

Sample Location	SW-1	SW-2	SW-3	SW-4	A	B	C	E	F	F, Duplicate	F Blank	G
Sample Number	GW-1	GW-9	GW-2	GW-4	GW-3	GW-5	GW-6	GW-10	GW-7	GW-7	GW-7	GW-8
Sample Date	9/20/86	10/1/86	9/20/86	9/20/86	9/20/86	9/21/86	9/21/86	10/2/86	10/1/86	10/1/86	10/1/86	10/1/86
Parameter (mg/l)												
Methylene Chloride	0.180	0.007	0.100	0.170	0.170	610.0	1500.0	LD	0.047	0.007	LD	270.0
Toluene	0.002(J)	LD	LD	0.003(J)	0.002(J)	LD	LD	LD	LD	0.006	LD	3.6(J)
Xylene	LD	LD	LD	LD	LD	LD	LD	LD	0.012	0.017	LD	LD
1,2 Diethoxyethane	LD	LD	0.020(J)	LD	LD	LD	LD	LD	LD	LD	LD	LD
1,1 Dichloroethane	LD	LD	LD	0.012	LD	LD	LD	LD	LD	LD	LD	LD
2-Methyl, 2-Propanol	LD	LD	LD	0.010	LD	LD	LD	LD	LD	LD	LD	LD
2,2' Propane, Oxybis	LD	LD	LD	0.100	LD	LD	LD	LD	LD	LD	LD	LD
Vinyl Chloride	LD	LD	LD	LD	LD	LD	LD	LD	0.024	0.030	LD	LD
Trans, 1,2,- Dichloroethylene	LD	LD	LD	LD	LD	LD	LD	LD	0.240	0.250	LD	LD
TOC	7.6	20.9	83.8	9.6	1.3	83.8	134.0	4.6	5.5	5.7	1.1	44.5
TOX	LD	0.022	0.180	0.016	LD	25.0	40.0	0.026	0.170	0.160	0.011	53.0

NOTES:

1. Wells E, F and G were installed in September 1986.
2. LD indicates less than the detection limit.
3. Isopropyl ether (2-2' Oxybispropane) is not a regulated hazardous chemical.
4. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory reports in Appendix C.
5. (J) indicates compound identified and concentration estimated below the detection limit.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 64

GROUNDWATER MONITORING RESULTS
INORGANIC ANALYSES
SEPTEMBER/OCTOBER 1986

Sample Location	SW-1	SW-2	SW-3	SW-4	A	B	C	E	F	F, Duplicate	F Blank	G
Sample Number	GW-1	GW-9	GW-2	GW-4	GW-3	GW-5	GW-6	GW-10	GW-7	GW-7	GW-7	GW-8
Sample Date	9/20/86	10/1/86	9/20/86	9/20/86	9/20/86	9/21/86	9/21/86	10/2/86	10/1/86	10/1/86	10/1/86	10/1/86
Parameter (mg/l)												
Arsenic (1)	LD	LD	LD	LD	LD	0.018	LD	LD	LD	LD	LD	LD
Barium	LD	0.070	LD	LD	LD	0.280	0.090	LD	0.090	0.090	LD	0.140
Cadmium	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD
Chromium (T)	0.010	0.018	0.012	LD	LD	LD	LD	0.012	0.022	LD	LD	LD
Lead (1) (2)	LD	0.014	.006	LD	0.018	LD	LD	LD	LD	0.010	LD	LD
Mercury	0.001	0.0027	0.0003	0.0006	0.001	0.0009	0.0008	0.0007	0.0005	--	LD	0.0003
Selenium	LD	LD	(S)	LD	LD	LD	LD	LD	LD	LD	LD	LD
Silver	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD
pH	7.12	6.84	7.54	7.10	6.32	6.11	5.87	6.37	7.74	--	--	6.82
Conductivity-umohs/cm	3000	1350	9500	3500	1400	3250	1700	1750	1800	--	--	4000

NOTES:

1. Spike sample recovery was not within the control limits.
2. Duplicate analysis was not within the control limits.
3. NA is not applicable.
4. -- indicates parameter not analyzed
5. Detection limits are provided in the laboratory reports in Appendix C.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 65

GROUNDWATER MONITORING RESULTS
INORGANIC ANALYSES
SEPTEMBER/OCTOBER 1986

Sample Location	SW-1	SW-2	SW-3	SW-4	A	B	C	E	F	F, Duplicate	F Blank	G
Sample Number	GW-1	GW-9	GW-2	GW-4	GW-3	GW-5	GW-6	GW-10	GW-7	GW-7	GW-7	GW-8
Sample Date	9/20/86	10/1/86	9/20/86	9/20/86	9/20/86	9/21/86	9/21/86	10/2/86	10/1/86	10/1/86	10/1/86	10/1/86
Parameter (mg/l)												
Copper	0.037	0.488	0.025	--	--	--	--	0.074	0.023	0.031	0.023	0.028
Iron	1.2	19.60	0.200	--	--	--	--	23.8	0.580	0.670	LD	--
Nickel	LD	LD	LD	--	--	--	--	LD	LD	LD	LD	0.179
Manganese	--	6.720	--	--	--	--	--	2.420	0.068	0.062	LD	3.580
Zinc	--	1.230	--	--	--	--	--	0.367	0.054	0.052	0.041	2.340
Chloride	16.0	84.0	330.0	--	--	--	--	530.0	170.0	170.0	LD	490.0
Fluoride	0.7	0.30	0.20	--	--	--	--	0.2	0.80	0.70	LD	0.70
Phosphorus (T)	LD	0.20	LD	--	--	--	--	LD	LD	LD	LD	LD
Sulfate	480.0	93.0	2200.0	--	--	--	--	135.0	77.0	75.0	LD	142.0

NOTES:

1. LD indicates less than the detection limit.
2. -- indicates parameter was not analyzed.
3. Refer to laboratory results in Appendix C for detection limits.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 66

GROUNDWATER MONITORING RESULTS
ORGANIC ANALYSES
FEBRUARY 1987

Sample Location	Well A	Well A Duplicate	SW-3	SW-4	Well G
Sample Number	W-1	W-1A	W-2	W-3	W-4
Sample Depth (ft)	2/20/87	2/20/87	2/20/87	2/20/87	2/20/87
Parameter (mg/l)					
Methylene Chloride	LD	LD	0.005	0.230	730
Acetone	0.026	0.029	0.004 (J)	0.190	730
Vinyl Chloride	LD	LD	LD	0.012	LD
1,1 Dichloroethane	0.007	0.006	LD	0.013 (J)	LD
Trans, 1-2 Dichloroethylene	LD	LD	LD	0.014 (J)	LD
Ethyl Ether	LD	LD	0.022 (J)	LD	LD
1,4-Dioxane	LD	LD	0.009 (J)	LD	LD
Isopropyl Ether (3)	LD	LD	LD	0.097 (J)	LD

NOTES:

1. LD indicates less than the detection limit.
2. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample refer to the laboratory reports in Appendix C.
3. Isopropyl ether is not regulated as a hazardous substance.
4. (J) indicates compound identified and concentration estimated below the detection limit.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 67

GROUNDWATER MONITORING RESULTS
INORGANIC ANALYSIS
APRIL 1988

Sample Location	SW-1	SW-2	SW-3	SW-3(Dup)	SW-4	A	B	C	E	E, Blank	F	G	H
Sample ID	MWSW1	MWSW2	MWSW3	MWSW3D	MWSW4	MWA	MWB	MWC	MWE	MWEFB	MWF	MWG	MWH
Sample Date	4/13/88	4/13/88	4/14/88	4/14/88	4/14/88	4/14/88	4/14/88	4/14/88	4/13/88	4/13/88	4/13/88	4/15/88	4/15/88
Parameter (mg/l)													
Arsenic	LD	LD	LD	LD	0.030	LD	0.012	LD	LD	LD	LD	LD	LD
Barium	LD	LD	LD	LD	LD	LD	0.359	0.090	LD	LD	LD	LD	0.071
Cadmium	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	0.009	0.005
Chromium	LD	LD	LD	LD	LD	0.001	LD	LD	LD	LD	LD	LD	0.025
Copper	0.029	0.031	LD	LD	LD	LD	LD	LD	LD	0.024	LD	LD	LD
Iron	LD	LD	0.313	0.196	45.80	45.6	LD	74.7	1.82	LD	LD	131.0	131.0
Lead (1)	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD
Mercury	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD
Zinc	0.058	0.023	LD	0.013	LD	0.032	0.018	0.032	0.013	LD	LD	0.034	0.028

NOTES:

1. Spike sample recovery was not within the control limits.
2. LD indicates less than the detection limit. Detection limits are provided in the laboratory reports in Appendix C.
3. Dup: Indicates Duplicate Samples.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 6B

GROUNDWATER MONITORING RESULTS
ORGANIC ANALYSIS
APRIL 1988

Sample Location	SW-1	SW-2	SW-3	SW-4	A	B	C	E	F	G	G, Dup	G, Blank	H
Sample ID	MW-SW-1	MW-SW-2	MW-SW-3	MW-SW-4	MW-A	MW-B	MW-C	MW-E	MW-F	MW-G	MW-G Dup	MWG-FB	MW-H
Sample Date	4/13/14	4/13/88	4/14/88	4/14/88	4/14/88	4/14/88	4/14/88	4/13/88	4/13/88	4/15/88	4/15/88	4/15/88	4/15/88
Parameter (mg/l)													
Chloromethane	0.011	LD	LD	LD	LD	0.025	LD	LD	LD	LD	LD	LD	LD
Vinyl Chloride	LD	LD	LD	0.014	LD	0.019	LD	LD	LD	LD	LD	LD	LD
Chloroethane	LD	LD	LD	0.005(J)	LD	0.042	LD	LD	LD	LD	LD	LD	LD
Methylene Chloride (1)	LD	0.010	LD	LD	0.011	330.0	7400.0	LD	LD	280.0	250.0	LD	LD
Acetone (1)	0.030	0.021	0.012	0.013	0.009(J)	LD	LD	LD	0.008(J)	LD	LD	0.011	0.006(J)
Carbon Disulfide	LD	LD	LD	LD	LD	0.008	LD	LD	LD	LD	LD	LD	LD
1,1-Dichloroethene (1)	0.006	LD	0.004(J)	0.005	0.007	0.025	41.0(J)	0.005	0.005	LD	LD	LD	0.004(J)
1,1-Dichloroethane	LD	LD	LD	0.012	0.029	(Note 5)	LD	LD	LD	LD	LD	LD	LD
1,2-Dichloroethene	LD	LD	LD	0.070	LD	(Note 5)	LD	LD	0.260	LD	LD	LD	LD
1,2-Dichloroethane	LD	LD	LD	LD	LD	0.009	LD	LD	LD	LD	LD	LD	LD
2-Butanone (1)	0.007(J)	0.006(J)	0.007(J)	LD	0.006(J)	LD	420.0	0.004(J)	0.006(J)	7.20(J)	LD	0.011	0.007(J)
1,1,1-Trichloroethane	LD	0.005	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD
Vinyl Acetate (1)	0.007(J)	0.006(J)	LD	LD	0.006(J)	20.0	LD	0.004(J)	0.006(J)	LD	LD	LD	LD
Trichloroethene	LD	LD	LD	LD	LD	(Note 5)	LD	LD	LD	LD	LD	LD	LD
4-Methyl-2-Pentanone (1)	LD	LD	LD	0.030	LD	0.070	LD	LD	LD	LD	LD	0.023	LD
2-Hexanone (1)	LD	LD	0.008(J)	LD	LD	LD	LD	LD	LD	LD	LD	0.093	LD

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Table 68 continued . . .

Sample Location	SW-1	SW-2	SW-3	SW-4	A	B	C	E	F	G	G, Dup	G, Blank	H
Sample ID	MW-SW-1	MW-SW-2	MW-SW-3	MW-SW-4	MW-A	MW-B	MW-C	MW-E	MW-F	MW-G	MW-G Dup	MWG-FB	MW-H
Sample Date	4/13/14	4/13/88	4/14/88	4/14/88	4/14/88	4/14/88	4/14/88	4/13/88	4/13/88	4/15/88	4/15/88	4/15/88	4/15/88
Parameter (mg/l)													
Tetrachloroethene	LD	LD	LD	LD	0.010	0.150	LD	LD	LD	LD	LD	LD	LD
Toluene	LD	LD	LD	LD	LD	0.850	LD	LD	LD	LD	LD	LD	LD
Ethylbenzene	LD	LD	LD	LD	LD	0.033	LD	LD	LD	LD	LD	LD	LD
Total Xylenes	LD	LD	LD	LD	LD	0.062	LD	LD	LD	LD	LD	LD	LD
Ethane, 1,1,2-Trichloro-1,2,	LD	LD	0.005(J)	LD	0.022(J)	LD	LD	LD	LD	9.10(J)	1.9(J)	LD	LD
7,10-Methanofluoranthen-11-0	LD	LD	LD	0.001(J)	LD	LD	LD	LD	LD	LD	LD	LD	LD
Diisopropyl Ether (DOT)	LD	LD	LD	0.120(J)	LD	LD	LD	LD	LD	LD	LD	LD	LD
Ethane, 1,2-Dichloro-1,1,2-T	LD	LD	LD	LD	0.071(J)	LD	LD	LD	LD	LD	LD	LD	LD

NOTES:

1. Compounds identified in blank samples.
2. LD indicats less than the detection limit.
3. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample refer to the laboratory reports in Appendix C.
4. J indicates compound identified and concentration estimated below the detection limit.
5. Compound was detected but the concentration exceeded the calibration range of the GC/MS and in accord with CLP protocol the sample was diluted and reanalyzed. The concentration of this compound was below the detection limit of the diluted sample and therefore could not be quantified.
6. Dup: Indicates duplicate analysis.

APPENDIX C

SOLVENT TANK FARM SOIL SAMPLING ANALYSES

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 13

TANK FARM SOIL SAMPLING
ORGANIC ANALYSES

Sample Location	SB-1	SB-3	SB-4	SB-4	SB-4	Well C	SB-11	SB-17
Sample Number	SS-158	SS-165	SS-176	SS-176 Dup.	SS-176 Blank	SS-66	SS-93	SS-108
Sample Depth (ft)	1.5-3.0	3.0-4.5	1.5-3.0	1.5-3.0	NA	3.0-4.5	1.5-3.0	1.5-3.0
Parameter (mg/kg)								
Methylene Chloride	0.810 (J)	4.3	2.5	4.0	0.031	4.6	13.0	0.093
Acetone	5.9	8.5	5.6	4.1	0.055	7.4	11.0 (J)	0.074
2-Butanone	11.0	8.3	7.7	7.1	LD	3.2	LD	LD
Tetrachloroethylene	LD	2.1	2.2	0.990	LD	LD	15.0	0.007 (J)
Toluene	LD	LD	0.720	0.790	LD	1.4	330.0	LD
Ethyl Benzene	LD	LD	1.7	1.8	LD	1.3	110.0	LD
Total Xylene	5.2	LD	8.8	9.3	LD	6.3	490.0	LD
1,1,2-Trichloro-1,2,2-Trifluoroethane	LD	LD	LD	LD	0.020 (J)	LD	LD	0.100 (J)
Trimethylsilanol	LD	LD	LD	LD	0.007 (J)	LD	LD	LD
1,2,3-Trimethyl Benzene	LD	LD	LD	LD	LD	4.0 (J)	LD	LD
1-Ethyl-2-Methyl Benzene	LD	LD	LD	LD	LD	3.0 (J)	LD	LD
Tetrahydrofuran	LD	LD	LD	LD	LD	LD	LD	0.010 (J)
Total VOCs	22.91	23.2	29.22	28.08	0.113	31.2	969.0	0.284
OVA Reading (ppm)	200	GT1000	1000	---	---	GT1000	GT1000	8.5

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.
2. (J) indicates compound identified at a concentration estimated below the detection limit.
3. Dup. indicates duplicate analyses
4. GT indicates greater than.

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HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 14

TANK FARM SOIL SAMPLING
ORGANIC ANALYSES

Sample Location	SB-1	SB-1	SB-1	SB-3	SB-4	SB-4	Well C
Sample Number	SS-162	SS-162 Dup.	SS-162 Blank	SS-167	SS-179	SS-179 RA	SS-70
Sample Depth (ft)	16.5-17.0	16.5-17.0	NA	12.0-13.5	12-13.5	12-13.5	16.0-17.5
Parameter (mg/kg)							
Methylene Chloride	0.260	0.480	0.031	29.0	58.0	110.0	21.0
Acetone	0.940	0.620	0.017	52.0	17.0	26.0	4.1
1,1-Dichloroethane	LD	LD	LD	LD	LD	LD	0.300 (J)
2-Butanone	0.044	0.072	LD	36.0	6.2	8.3	5.2
1,1,1-Trichloroethane	0.031	0.110	LD	42.0	LD	8.6	LD
Trichloroethylene	LD	0.026 (J)	LD	LD	LD	6.1	LD
Tetrachloroethylene	LD	0.062	LD	800.0	LD	LD	LD
Toluene	0.028	0.081	LD	32.0	LD	LD	4.5
Ethyl Benzene	LD	0.006 (J)	LD	LD	LD	LD	0.440 (J)
Total Xylene	0.006 (J)	0.015 (J)	LD	LD	LD	LD	2.0
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.200 (J)	0.200 (J)	0.020 (J)	LD	LD	LD	LD
Chloroform	LD	LD	LD	LD	LD	LD	LD
4-Methyl-2-Pentanone	LD	LD	LD	LD	LD	LD	LD
Total VOCs	1.509	1.672	0.068	991	81.2	159	37.54
OVA Reading (ppm)	3.0	---	---	GT 1000	GT 1000	---	GT 1000

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (J) indicates compound identified at a concentration estimated below the detection limit.

3. RA indicates reanalysis. Sample SS-179 was reanalyzed. Samples SS-179 and SS-179 RA had low volatile organic analysis (VOA) surrogates for Toluene-D8 and Bromofluorobenzene. This indicates matrix interference. See "Water Surrogate Percent Recovery" in Appendix C.

4. NA indicates not applicable

5. Dup. indicates duplicate analyses

6. GT indicates greater than.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 15

TANK FARM SOIL SAMPLING
ORGANIC ANALYSES

Sample Location	Well C	Well C	SB-11	SB-11	SB-11	SB-11	SB-17
Sample Number	SS-70 Dup.	SS-70 Blank	SS-96	SS-96 RA	SS-96 Dup.	SS-96 Blank	SS-110
Sample Depth (ft)	16.0-17.5	NA	12-13.5	12-13.5	12-0-13.5	NA	7.5-9.0
Parameter (mg/kg)							
Methylene Chloride	16.0	0.015	3.7	1.6 (J)	1.7	0.015	0.015
Acetone	2.8	0.002 (J)	13.0	5.4 (J)	1.7	0.005 (J)	0.006 (J)
1,1-Dichloroethane	0.300 (J)	LD	LD	LD	LD	LD	LD
2-Butanone	3.2	0.003 (J)	3.9	8.3	2.7	0.002 (J)	LD
1,1,1-Trichloroethane	LD	LD	LD	LD	0.390 (J)	LD	LD
Trichloroethylene	LD	LD	LD	LD	LD	LD	LD
Tetrachloroethylene	0.320 (J)	LD	2.2 (J)	1.4 (J)	1.1 (J)	LD	LD
Toluene	10.0	LD	54.0	32.0	25.0	0.001 (J)	LD
Ethyl Benzene	0.720	LD	25.0	15.0	12.0	LD	LD
Total Xylene	3.3	LD	110.0	70.0	51.0	LD	LD
1,1,2-Trichloro-1,2,2-Trifluoroethane	LD	LD	LD	LD	LD	LD	LD
Chloroform	LD	0.001 (J)	LD	LD	LD	LD	LD
4-Methyl-2-Pentanone	LD	LD	LD	2.8 (J)	1.4 (J)	LD	LD
Styrene	LD	LD	LD	LD	LD	0.003 (J)	LD
Total VOCs	36.64	0.021	211.8	136.5	96.99	0.026	0.021
OVA Reading (ppm)	---	---	+1000	---	---	---	15.4

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (J) indicates compound identified at a concentration estimated below the detection limit.

3. NA indicates not applicable

4. Dup. indicates duplicate analyses

5. Sample number SS-96 was reanalyzed (SS-96 RA) because VOA surrogates were outside QC limits. Sample SS-96 RA surrogates were within QC limits.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 16

TANK FARM SOIL SAMPLING
ORGANIC ANALYSES

Sample Location	SB-8	SB-8	SB-8	SB-6	SB-7	SB-12	SB-18
Sample Number	SS-122	SS-122 Dup.	SS-122 Blank	SS-171	SS-181	SS-101	SS-116
Sample Depth (ft)	1.5-3.0	1.5-3.0	NA	1.5-3.0	1.5-3.0	3.0-4.5	3.0-4.5
Parameter (mg/kg)							
Methylene Chloride	1.1	1.0 (J)	0.026	0.980	3.6	2.2	14.0
Acetone	4.3	5.5	0.015	2.9	12.0	19.0	3.5
Trans-1,2 Dichloroethylene	LD	0.430 (J)	LD	LD	LD	1.7	LD
2-Butanone	4.7	8.8	LD	5.6	6.3	6.3	5.3
1,1,1 Trichloroethane	LD	LD	LD	LD	7.0	LD	6.0
Trichloroethylene	LD	LD	LD	LD	17.0	LD	7.7
4-Methyl-2-Pentanone	LD	LD	LD	LD	LD	LD	4.3
Tetrachloroethylene	4.5	8.0	LD	LD	LD	LD	2.1
Toluene	LD	LD	LD	LD	65.0	LD	26.0
Ethyl Benzene	LD	LD	LD	1.3	13.0	0.540	8.1
Total Xylene	LD	LD	LD	3.0	67.0	4.5	47.0
1,1,2 Trichloro-1,2,2 Trifluoroethane	LD	LD	0.020 (J)	LD	LD	LD	LD
Trimethylsilanol	LD	LD	0.005 (J)	LD	LD	LD	LD
1,1,2 Trimethylcyclohexane	LD	9.0	LD	LD	LD	LD	LD
2,3,4-Trimethylhexane	LD	22.0	LD	LD	LD	LD	LD
Total VOCs	14.6	54.73	0.066	13.780	190.9	34.24	124.0
OVA Reading (ppm)	100	--	--	GT 1000	GT 1000	GT 1000	GT 1000

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (J) indicates compound identified at a concentration estimated below the detection limit.

3. Dup. indicates duplicate analyses

4. Sample number SS-122 and SS-122 Dup were analyzed outside the 14 day holding time. Actual holding time was 16 days.

5. GT indicates greater than.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 17

TANK FARM SOIL SAMPLING
ORGANIC ANALYSES

Sample Location	SB-8	SB-6	SB-7	SB-12	SB-18
Sample Number	SS-126	SS-173	SS-184	SS-106	SS-119
Sample Depth (ft)	16.5-17.0	7.5-9.0	12.0-13.5	23.5-24.0	16.5-17.0
Parameter (mg/kg)					
Methylene Chloride	1.4	27.0	0.270	0.078	0.160
Acetone	4.9	37.0	0.200	0.250	0.170
2-Butanone	5.0	32.0	0.036 (J)	0.023 (J)	0.019 (J)
1,1,1 Trichloroethane	LD	LD	0.090	LD	0.011 (J)
Tetrachloroethylene	19.0	LD	LD	LD	LD
Toluene	LD	340.0	0.073	0.051	0.026
Ethyl Benzene	LD	120.0	0.005 (J)	0.012 (J)	LD
Total Xylene	LD	450.0	0.025 (J)	0.071	0.028
1,1,2 Trichloro-1,2,2 Trifluoroethane	LD	LD	0.050 (J)	LD	0.030 (J)
Trimethylsilanol	LD	LD	0.040 (J)	LD	0.010 (J)
Total VOCs	30.3	1006.	0.789	0.485	0.454
OVA Readings (ppm)	20	GT1000	120	90	30

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.
2. (J) indicates compound identified at a concentration estimated below the detection limit.
3. Dup. indicates duplicate analyses
4. NA indicates not applicable
5. GT indicates greater than

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 18

SOIL SAMPLING
OUTSIDE TANK FARM BERM
ORGANIC ANALYSES

Sample Location	SB-9	SB-9	Well A	Well A	Well A	Well B	Well B	Well B	Well B	Well B	SB-10	SB-10
Sample Number	SS-76	SS-79	SS-53	SS-55	SS-56	SS-59	SS-59 Dup	SS-59 Blank	SS-60	SS-63	SS-84	SS-90
Sample Depth (ft)	1.5-3.0	12.0-13.5	7.5-9.0	16.5-17.0	20.0-20.5	3.0-4.5	3.0-4.5	NA	7.5-9.0	20.5-21.0	4.5-6.0	19.0-20.0
Parameter (mg/kg)												
Methylene Chloride	0.017	.021	1.9	0.005	0.011	0.007	0.010	0.023	0.007	0.011	0.058	5.1
Acetone	0.020	.035	0.820 (J)	0.030	0.026	0.033	0.043	0.076	0.110	0.070	0.570	8.5
2-Butanone	LD	.004 (J)	2.4	0.005	LD	0.005 (J)	LD	LD	0.027	0.005 (J)	0.160	3.8
1,1,1-Trichloroethane	LD	LD	LD	0.006	LD	LD	LD	LD	LD	LD	LD	LD
4-Methyl-2-Pentanone	LD	LD	LD	LD	0.005	LD	LD	LD	LD	LD	LD	LD
2-Hexanone	LD	LD	LD	0.005 (J)	LD	LD	LD	LD	LD	0.005 (J)	LD	LD
1,1 Dichloroethane	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	0.009(J)	LD
Toluene	0.002 (J)	LD	9.8	0.032	0.042	LD	LD	LD	0.004 (J)	0.001 (J)	0.038	1.1
Ethyl Benzene	LD	LD	5.8	0.007	0.013	LD	LD	LD	LD	LD	LD	3.6
Total Xylenes	LD	LD	29.0	0.032	0.055	LD	LD	LD	0.002 (J)	LD	LD	18.0
1,1,2-Trichloro-1,2,2-Trifluoroethane	LD	LD	LD	0.010 (J)	0.010 (J)	0.020 (J)	0.40 (J)	LD	0.010 (J)	LD	LD	LD
Trichlorofluoromethane	LD	LD	LD	LD	0.009 (J)	LD	LD	LD	LD	LD	LD	LD
Carbon Disulfide	LD	LD	LD	LD	LD	LD	LD	LD	LD	0.005 (J)	LD	LD
Propyl Benzene	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	LD	3.0 (J)
Total VOCs	0.039	0.06	49.72	0.132	0.171	0.065	0.453	0.099	0.16	0.097	0.835	43.1
OVA Reading (ppm)	3.0	4.0	GT 1000	68	2.6	0	--	--	55	1.5	50	GT 1000

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.
2. (J) indicates compound identified at a concentration estimated below the detection limit.
3. Dup. indicates duplicate analyses.
4. NA indicates not applicable.
5. GT indicates greater than.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 19

TANK FARM SOIL SAMPLING
METALS ANALYSES

Sample Location	SB-3	SB-6	SB-11
Sample Number	SSM-167	SSM-173	SSM-92
Sample Depth (ft)	12.0-13.5	7.5-9.0	0-1.5
Parameter (mg/kg)			
Arsenic	19	15	13
Barium	LD	45	202
Cadmium	LD	LD	4.8
Chromium (T)	LD	LD	LD
Lead	23	10	5.3
Mercury	LD	LD	LD
Selenium	LD	LD	LD
Silver	LD	LD	LD
% Solids	88	88	93

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 20

TANK FARM SOIL SAMPLING
EP TOXICITY ANALYSES

Sample Location	SB-3	SB-6	SB-11
Sample Number	SSM-167	SSM-173	SSM-92
Sample Depth (ft)	12.0-13.5	7.5-9.0	0-1.5
Parameter (mg/l)			
Arsenic	LD	LD	LD
Barium	LD	0.55	1.2
Cadmium	LD	LD	LD
Chromium (T)	LD	LD	LD
Lead	LD	LD	LD
Mercury	LD	LD	LD
Selenium	LD	LD	LD
Silver	LD	LD	LD

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

APPENDIX D

<u>CISTERN LIQUID, SEDIMENT AND SOIL BORING ANALYTICAL RESULTS</u>

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 30

SAMPLING RESULTS
ORGANIC ANALYSES

Sample Location	Cistern	Cistern Inlet Pipe
Sample Number	CS-1	CS-6
Parameter (mg/l)		
Acetone	980.0	510.0
2-Butanone	360.0	440.0
Methylene Chloride	1300.0	300.0
Toluene	39.0 (J)	110.00
Xylene	LD	77.0
Butyl Acetate	LD	60.0
Ethyl Benzene	LD	16.0
4-Methyl, 2-Pentanone	LD	1100.0
Hexanone	LD	79.0
Mineral Spirits	SEE NOTE 3	
TOC	2760.0	--
TOX	23.0	--

NOTES:

1. LD indicates less than the detection limit.
2. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample refer to the laboratory reports in Appendix C.
3. Laboratory analysis identified floating oil layer on samples CS-1 and CS-6 as mineral spirits.
4. -- indicates parameter was not analyzed.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 31

CISTERN LIQUID
METALS ANALYSES

Sample Number	CS-1
Parameter (mg/l)	
Arsenic	LD
Barium	0.120
Cadmium	LD
Chromium	0.048
Lead	LD
Mercury	0.6
Selenium	LD
Silver	LD

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 32

CISTERN RESIDUE
ORGANIC ANALYSES

Sample Number	CSS-1
Parameter (mg/kg)	
Acetone	9,300.0
Methyl Ethyl Ketone	8,000.0
1,1,1-Trichloroethane	34,000.0
Methylene Chloride	140,000.0
Trichloroethylene	8,100.0 (J)
Toluene	21,000.0
Xylene	22,000.0
Ethyl Benzene	4,500.0

NOTES:

1. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific compound refer to the laboratory reports in Appendix C.

2. J indicates compound identified at a concentration estimated below the detection limit.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 33

CISTERN RESIDUE
METALS ANALYSES

Sample Number	CSS-1
Parameter (mg/kg)	
Arsenic	17
Barium	4630
Cadmium	92
Chromium	3390
Lead	7130
Mercury	3.5
Selenium	LD
Silver	LD
% Solids	35

NOTES:

1. LD indicates less than the detection limit. Refer to Appendix C for the specific sample detection limit.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 34

CISTERN RESIDUE
EP TOXICITY ANALYSES

Sample Number	CSS-1
Parameter (mg/l)	
Arsenic	LD
Barium	0.490
Cadmium	0.300
Chromium	0.200
Lead	LD
Mercury	LD
Selenium	LD (R)
Silver	0.010

NOTES:

1. LD indicates less than the detection limit. Refer to Appendix C for the specific sample detection limit.
2. (R) indicates spike sample recovery was not within control limits.

HUKILL CHEMICAL CORPORATION
BEDFORD, OHIO

TABLE 35

CISTERN BORINGS
ORGANIC ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4	SBC-5	SBC-6
Sample Number	SS-128	SS-133	SS-137	SS-144	SS-148	SS-152
Sample Depth (ft)	0.5-2.0	0.5-2.0	0.5-2.0	0.5-2.0	0.5-2.0	0.5-2.0
Parameter (mg/kg)						
Methylene Chloride	1.6	730	78 (J)	63	41	6.8
Acetone	23	LD	LD	240	160	LD
2-Butanone	10	LD	LD	320	130	9 (J)
1,1,1 Trichloroethane	2.4	LD	160	LD	LD	LD
4-Methyl-2 Pentanone	4.3	LD	LD	LD	19	LD
Tetrachloroethylene	15	LD	280	330	LD	9.9
Toluene	14	2600	1600	91	7.2	47
Chlorobenzene	18	LD	LD	LD	LD	LD
Ethyl Benzene	4.2	670	510	24 (J)	1.3 (J)	20
Xylene	19	2700	2000	130	6.6	120
Total VOCs	111.5	6700	4628	1198	365.1	212.7
OVA Readings (ppm)	GT 1000	GT 1000	GT 1000	GT 1000	GT 1000	GT 1000

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.
2. (J) indicates compound identified at a concentration estimated below the detection limit.
3. GT indicates greater than.

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TABLE 36

CISTERN BORINGS
ORGANIC ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4	SBC-5	SBC-6
Sample Number	SS-131	SS-135	SS-139	SS-146	SS-150	SS-154
Sample Depth (ft)	8.0-9.5	8.0-9.5	8.0-9.5	8.0-9.5	6.5-8.0	8.0-9.0
Parameter (mg/kg)						
Methylene Chloride	380	0.7	84	1.7	--	--
Acetone	1000	5.3	45	6.9	--	--
2-Butanone	1500	5.8	76	9.3	--	--
1,1,1 Trichloroethane	LD	LD	5	LD	--	--
4-Methyl-2 Pentanone	LD	LD	27	LD	--	--
Tetrachloroethylene	LD	LD	4.2	LD	--	--
Toluene	680	LD	41	1.5	--	--
Chlorobenzene	LD	LD	LD	LD	--	--
Ethyl Benzene	200 (J)	LD	13	0.29 (J)	--	--
Xylene	940	LD	47	1 (J)	--	--
Total VOCs	4700	11.8	342.2	20.69	--	--
OVA Readings (ppm)	GT 1000	900	--	850	320	400

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.
2. (J) indicates compound identified at a concentration estimated below the detection limit.
3. -- indicates sample collected, but not submitted for laboratory analyses.
4. Sample number SS-135 was analyzed outside the 14 day holding time. Actual holding time was 16 days.
5. GT indicates greater than.

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TABLE 37

CISTERN BORINGS
ORGANIC ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4	SBC-5	SBC-6	SBC-6
Sample Number	SS-132	SS-136	SS-140	SS-147	SS-151	SS-155	SS-155 RA
Sample Depth (ft)	13.0-14.5	13.0-14.5	13.0-14.5	13.0-14.5	13.0-14.5	13.0-14.5	13.0-14.5
Parameter (mg/kg)							
Methylene Chloride	6.8	1.7	8.5	1.8	4.3	0.21	0.21
Acetone	16	7.8	32	3.2	12	0.14	0.11
2-Butanone	16	6.6	49	5.4	15	0.006(J)	LD
1,1,1 Trichloroethane	LD	LD	LD	LD	LD	0.043	0.037
4-Methyl-2 Pentanone	7.9	LD	11	3.2	2.8	LD	LD
Tetrachloroethylene	LD	LD	4.8	0.88	LD	0.041	0.042
Toluene	29	9.1	24	11.0	7.5	0.180	0.160
Chlorobenzene	LD	LD	LD	LD	LD	LD	LD
Ethyl Benzene	6	2.7	7.8	5.2	2.1	0.037	0.035
Xylene	27	13	32	23	8.7	0.180	0.190
Trans-1,2 Dichloroethylene	LD	LD	LD	LD	LD	0.008	LD
Trichloroethylene	LD	LD	LD	LD	LD	0.010	0.010 (J)
1,1,2-Trichloro -1,2,2-Trifluoroethane	LD	LD	LD	LD	LD	0.090 (J)	0.060 (J)
Trimethylsilanol	LD	LD	LD	LD	LD	LD	0.030 (J)
Total VOCs	108.7	40.9	169.1	53.68	52.4	0.945	0.884
OVA Readings (ppm)	GT 1000	GT 1000	--	GT 1000	340	140	--

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.
2. (J) indicates compound identified at a concentration estimated below the detection limit.
3. Sample number SS-136 was analyzed outside the 14 day holding time. Actual holding time was 16 days.
4. The surrogate recoveries for sample number SS-155 were outside the QC limits due to matrix effects. Refer to the "Soil Surrogate Percent Recovery Summary" in Appendix C. Sample was reanalyzed SS-155RA.

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TABLE 38

CISTERN BORINGS
ADDITIONAL SAMPLING DEPTHS
ORGANIC ANALYSIS

Sample Location	SBC-3	SBC-3	SBC-3
Sample Number	SS-138	SS-142	SS-143
Sample Depth	5.0-6.5	21.5-22.0	27.0-27.5
Parameter (mg/kg)			
Methylene Chloride	19 (J)	6.1	2.7
Acetone	100	38	16.
2-Butanone	46 (J)	22	22
4-Methyl-2-Pentanone	LD	LD	4.2
Toluene	120	3.4	2.3
Ethyl Benzene	43	1.0 (J)	0.82 (J)
Xylene	200	5.4	3.3
Total VOCs	528	75.9	51.32
OVA Reading (ppm)	GT 1000	100	GT 1000

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (J) indicates compound identified at a concentration estimated below the detection limit.

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TABLE 39

CISTERN SOIL SAMPLING
METALS ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4
Sample Number	SS-128	SS-133	SS-137	SS-144
Sample Depth (ft)	0.5-2.0	0.5-2.0	0.5-2.0	0.5-2.0
Parameter (mg/kg)				
Arsenic	13	16	16	15
Barium	LD	LD	LD	LD
Cadmium	LD	LD	LD	LD
Chromium	LD	LD	LD	LD
Lead	5.3	7.8	10	15 (S)
Mercury	LD	LD	LD	LD
Selenium	LD	LD	LD	LD
Silver	LD	LD	LD	LD

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (S) indicates concentration determined by the method of standard addition.

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TABLE 40

CISTERN SOIL SAMPLING
METALS ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4
Sample Number	SSM-131	SSM-135	SSM-139	SSM-146
Sample Depth (ft)	8.0-9.5	8.0-9.5	8.0-9.5	8.0-9.5
Parameter (mg/kg)				
Arsenic	17	22	23	21
Barium	96	LD	76	LD
Cadmium	LD	LD	LD	4.1
Chromium	23	12	LD	18
Lead	70	12	21 (S)	15 (S)
Mercury	LD	LD	LD	LD
Selenium	LD	LD	LD	LD
Silver	LD	LD	LD	LD

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. Refer to Appendix C for the specific sample detection limit.

2. (S) indicates concentration determined by the method of standard addition.

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TABLE 41

CISTERN SOIL SAMPLING
METALS ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4
Sample Number	SSM-132	SSM-136	SSM-140	SSM-147
Sample Depth (ft)	13.0-14.5	13.0-14.5	13.0-14.5	13.0-14.5
Parameter (mg/kg)				
Arsenic	18	29	19	17
Barium	LD	LD	LD	LD
Cadmium	LD	4.1	5.3	LD
Chromium	16	15	11	12
Lead	9.9 (S)	19 (S)	9 (S)	LD
Mercury	LD	LD	LD	LD
Selenium (R)	LD	LD	LD	LD
Silver	LD	LD	LD	LD

NOTES:

1. LD indicates less than the detection limit. Refer to Appendix C for the specific sample detection limit.

2. (S) indicates concentration determined by the method of standard addition.

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TABLE 42

CISTERN SOIL SAMPLING
EP TOXICITY ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4
Sample Number	SSM-128	SSM-133	SSM-137	SSM-144
Sample Depth (ft)	0.5-2.0	0.5-2.0	0.5-2.0	0.5-2.0
Parameter (mg/l)				
Arsenic	LD	LD	LD	LD
Barium	0.24	0.15	0.16	0.23
Cadmium	LD	LD	0.017	LD
Chromium (T)	LD	LD	LD	LD
Lead	LD	LD	LD	LD
Mercury	LD	LD	LD	LD
Selenium (R)	LD	LD	LD	LD
Silver	0.01	0.01	0.01	0.01

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (R) indicates spike sample recovery was not within control limits.

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TABLE 43

CISTERN SOIL SAMPLING
EP TOXICITY ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4
Sample Number	SSM-131	SSM-135	SSM-139	SSM-146
Sample Depth (ft)	8.0-9.5	8.0-9.5	8.0-9.5	8.0-9.5
Parameter (mg/l)				
Arsenic	LD	LD	LD	LD
Barium	0.6	LD	0.26	LD
Cadmium	0.011	LD	LD	LD
Chromium (T)	LD	LD	LD	LD
Lead	0.043	LD	LD	LD
Mercury	0.002	0.002	LD	LD
Selenium (R)	LD	LD	LD	LD
Silver	0.01	0.01	0.01	0.01

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (R) indicates spike sample recovery was not within control limits.

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TABLE 44

CISTERN SOIL SAMPLING
EP TOXICITY ANALYSES

Sample Location	SBC-1	SBC-2	SBC-3	SBC-4
Sample Number	SSM-132	SSM-136	SSM-140	SSM-147
Sample Depth (ft)	13.0-14.5	13.0-14.5	13.0-14.5	13.0-14.5
Parameter (mg/l)				
Arsenic	LD	LD	LD	LD
Barium	LD	LD	0.07	LD
Cadmium	LD	LD	LD	LD
Chromium (T)	LD	LD	LD	LD
Lead	LD	LD	LD	LD
Mercury	0.005	LD	LD	LD
Selenium (R)	LD	LD	LD	LD
Silver	0.01	0.01	0.01	0.01

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (R) indicates spike sample recovery was not within control limits.

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TABLE 45

CISTERN BORINGS
PERCHED WATER ORGANIC ANALYSES

Sample Location	SB-36	SB-36A	SB-37
Sample Number	SS-24	SS-27	SS-19
Sample Date	9/18/86	9/18/86	9/18/86
Parameter (mg/l)			
Acetone	220.0	230.0	LD
Methylene Chloride	380.0	460.0	LD
2-Butanone	430.0	420.0	LD
Toluene	24.0	25.0	160.0
Isopropyl Alcohol	LD	30.0 (J)	LD
4-Methyl, 2-Pentanone	36.0 (J)	31.0 (J)	LD
Hexanone	360.0	240.0	LD
Tetrahydrofuran	70.0 (J)(3)	LD	LD
TOC	42,000.	38,500	49.9
TOX	49.	68	0.300

NOTES:

1. LD indicates less than the detection limit.
2. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample refer to the laboratory reports in Appendix C.
3. Result includes the concentration of propyl furan.
4. -- indicates parameter was not analyzed.
5. J indicates compound identified at a concentration below the detection limit.

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TABLE 46

CISTERN BORINGS

Sample Location	SB-34	SB-35	SB-37	SB-38	SB-38
Sample Number	SS-17	SS-6	SS-22	SS-11	SS-13
Sample Depth (ft)	3.5-5.0	17.5-18.0	12-13.5	3.5-5.0	12.5-13.5
Parameter (mg/kg)					
Methylene Chloride	0.012	0.510	0.074	11 (J)	0.130
Acetone	0.210	0.130	0.230	LD	0.570
2-Butanone	0.013 (J)	0.041 (J)	0.016 (J)	LD	0.170
1,1,1 Trichloroethane	LD	0.110	LD	LD	0.015
Trichloroethylene	LD	0.110	LD	LD	LD
Benzene	LD	LD	LD	LD	0.013 (J)
4-Methyl-2 Pentanone	LD	0.026 (J)	LD	LD	0.069
Tetrachloroethylene	LD	0.600	LD	LD	0.026
Toluene	LD	0.100	LD	37	0.250
Ethyl Benzene	LD	0.043	LD	16 (J)	0.029
Total Xylenes	LD	0.250	LD	82	0.110
1,1,2-Trichloro 1,2,2-Trifluoroethane	LD	LD	0.7 (J)	LD	0.400 (J)
Propane, 2-2' Oxybis	LD	LD	LD	LD	0.020 (J)
Total VOCs	0.235	1.92	1.02	146	1.802
OVA Reading (ppm)	100	100	3.5	GT 1000	12

NOTES:

1. LD indicates less than the detection limit. Detection limits are sample specific due to concentration ranges of organics in samples. For the detection limit of a specific sample, refer to the laboratory results in Appendix C.

2. (J) indicates compound identified at a concentration estimated below the detection limit.

APPENDIX E

HEALTH AND SAFETY PLAN FOR TANK FARM AND UNDERGROUND CISTERN CLOSURE

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I. Purpose

The purpose of this Health and Safety Plan (HASP) is to assign responsibilities, establish personnel protection standards, recommend operating procedures, and provide for contingencies that may arise during closure activities conducted at Hukill Chemical Corporation's (HCC) facility in Bedford, Ohio. The protocols in this HASP apply to all personnel involved in specific closure activities including employees of HCC and all outside contractors. These specific activities include: dewatering the cistern and plugging the inlet pipe; removing the earthen berm around the tank farm; excavating gravel to grade; removing perched water around the solvent tank farm sumps; and removing the solvent tank farm sumps.

This HASP was developed with the most recent and available information. If, through the closure activities, additional pertinent information to the safety of workers is made available, it will be used to amend this plan. In addition, the site manager may use this information to increase personnel protective measures on the study area site. All workers will be briefed on any amendments made to this plan.

II. Hazard Evaluation

Closure activities include placing a concrete cap over the existing tank farm area and backfilling the underground cistern. The soils beneath the tank farm and underground cistern are contaminated with solvents. There is a possibility that perched water around the sumps in the tank farm is also contaminated. These solvents when present in significant quantities may present a possible hazard of exposure by inhalation, skin contact and ingestion. Dusts which may be generated during gravel excavation and earthen dike removal may be contaminated with solvents and pose a potential hazard for skin absorption and incidental ingestion.

III. Responsibilities

There will be an on-site manager/safety officer present during the specific closure activities outlined in Section I of this HASP. This person is responsible for:

1. The implementation, enforcement and monitoring of the Site Health and Safety Plan.

2. The indoctrination of all personnel with regard to this safety plan other safety requirements to be observed during closure operations, including:

a. Potential hazards.
b. Personnel hygiene principles.
c. Personnel protective equipment.
d. Respiratory protective equipment usage and fit testing.
e. Emergency procedures dealing with fire and medical situations.

3. Maintenance and separation of the Exclusion, Decontamination and Support Zones and enforcing decontamination procedures.

4. Monitoring of hazards during closure operations.

5. Maintenance of log of (a) personnel closure area entry and exit times, (b) reason for entry, (c) description of activities performed by each individual, (d) problems encountered and actions taken, and (e) documentation of any chemical exposure symptoms to workers while on or after leaving the area.

6. Maintenance of closure area security by allowing only authorized individuals with proper training in the area.

IV. Closure Area Work Zones

In order to reduce the potential for contaminant migration and reduce the risk of personnel exposure to potentially hazardous substances, three zones will be established. The three zones are the: Exclusion Zone; Contamination Reduction Zone; and Support Zone. These zones are shown in Figure E-1.

The site manager will clearly lay out and identify the various closure area work zones. Limitations on equipment, operations and personnel in the three zones described below is the responsibility of the site manager.

A. Exclusion Zone

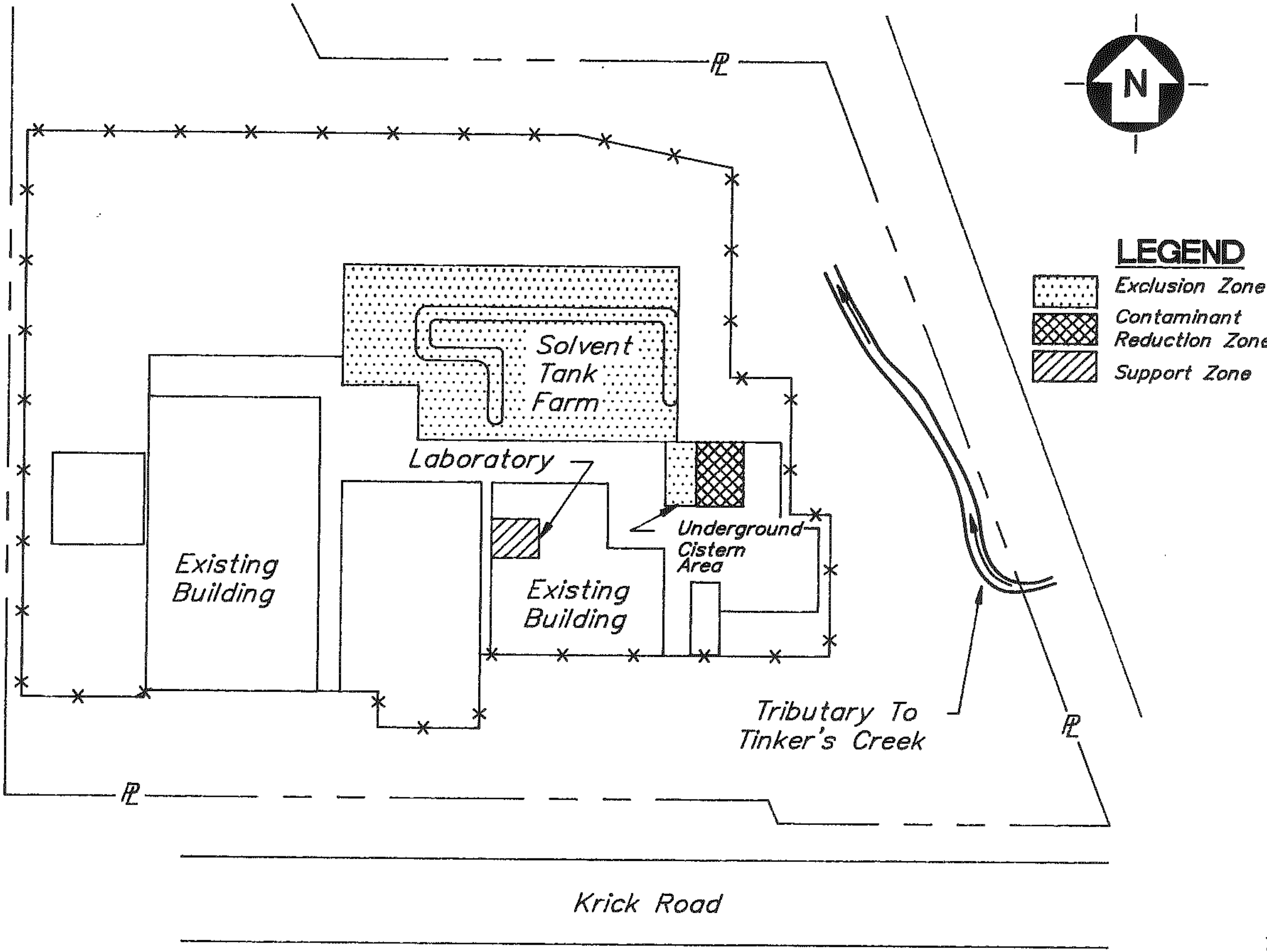
The Exclusion zone includes all areas where potentially contaminated soils, and perched water may be contacted. These areas will be clearly marked and personnel will be advised as to their location. Protection levels required in the Exclusion Zones are discussed in detail in Section VI of this HASP.

B. Contamination Reduction Zone

Contamination Reduction Zones are located contiguous and upwind of each Exclusion Zone. The Contamination Reduction Zone provides an area of decontamination for equipment, clothing and personnel prior to proceeding to the support Zone.

C. Support Zone

The Support Zone is the area outside the zone of significant contamination. An area inside the processing building at the HCC facility will serve as the support zone. The functions of the Support Zone include:



E-4

CLOSURE AREA WORK ZONES

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SK495–1D

FIGURE E–1

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1. An entry area and checkpoint for personnel, materials and equipment for closure area site operations.

2. An area for decontaminated personnel, materials and equipment.

3. Storage area for equipment.

4. Housing for site special services.

5. Storage of first-aid supplies.

The support area office will be located either inside HCC laboratory or main plant building. Field office provisions for personnel will be provided, including a desk, phone and secured personal area for equipment. The support area office will contain a list of all authorized personnel.

V. Site Entry Procedures

All personnel working in the closure area will enter their names in the site log, which will be maintained in the Support Zone. Personnel will be escorted throughout the plant to the closure area and enter through a designated entry/checkpoint at the Contamination Reduction Zone. Before engaging in any site work, all personnel involved in such work will be briefed on the following:

1. The person in charge as site manager.

2. Boundries and exit and entry point locations of the closure area.

3. Decontamination procedures when required.

4. Chemical contaminants potentially in the area and their signs and symptoms of exposure.

5. Location of first-aid equipment and qualified personnel.

6. Procedures to be used in contacting emergency response personnel, including potential evacuation procedures to be pursued in case of emergencies

7. Location of emergency exit equipment.

8. Location of emergency evacuation meeting point.

9. Contractor staff person in charge.

10. Activities taking place that day.

11. Location of emergency eyewash and shower station.

12. Heat stress symptoms. All personnel will be advised to watch for signs of stress in staff working in Exclusion Zone.

VI. Personnel Protection

A. Levels of Protection

The level of protection generally be Level D. Level B protection will be required when plugging the inlet pipe to the cistern. Table 1 lists the required equipment for protection Levels B, C and D.

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TABLE 1

PROTECTION LEVELS

Level D Protection

1. Hardhat

2. Safety Glasses

3. Steel-toed Work Boots

4. Chemical Resistant Gloves

Level C Protection

1. Disposable Chemical Resistant Tyvek or Saranex Coverall with Hood

2. Inner Chemical Resistant Gloves

3. Outer Chemical Resistant Gloves

4. Steel-toed Work Boots

5. Boot Covers, Chemical Resistant (disposable)

6. Hardhat

7. Full-face, Air Purifying Respirator with Combination Particulate and Organic Vapor Canister (only NIOSH/MSHA approved equipment will be used. Canister shall be approved for use against: 1) organic vapors up to 1,000 ppm; and 2) dusts with a TWA of greater than 0.05 mg/m^3.

Level B Protection

Same as Level C Protection except:

1. A self-contained breathing apparatus (SCBA) is required instead of the air purifying respirator.

   Levels of protection may be changed during site work on the basis on air quality monitoring as discussed in Section VIII of this HASP.

B. Surveillance Equipment and Materials

Before commencing the work described in the Plan at the HCC site, air quality samples will be monitored on the downwind sides of the tank farm area for organic vapors to establish background conditions. A discussion of the sampling procedures appears in the "Air Quality Monitoring Section" of this HASP.

During any work in the tank farm, air quality will be monitored for organic vapors using an organic vapor analyzer (OVA).

C. Medical Surveillance

In accordance with the USEPA's "Standard Operating Safety Guides" and OSHA CFR 29 Park 1910.120 (f), a yearly medical exam of the general state of health, baseline physiological data and ability to wear personnel protective equipment will be required for individuals engaged in on-site work activities. This site Health and Safety Plan addresses only emergency medical care and treatment.

D. Personnel Safety/Hygiene

The safety practices to be followed by all on-site personnel include:

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the Exclusion or Contamination Reduction Zone.

2. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activities.

3. Whenever decontamination procedures for outer garments are in effect, it is recommended that the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

4. No excessive facial hair, which interferes with a satisfactory fit of the mask-to-face seal, is allowed for personnel required to wear respiratory protective equipment.

5. Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, mud, and other discolored surfaces; kneel on ground, lean, sit or place equipment on drums, containers, vehicles, or the ground.

6. Medicine and alcohol can exaggerate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverages will not be allowed during site operations.

Fluids will be provided to staff to replace perspiration and will be sealed in containers. All fluids for ingestion will be kept in the support area.

Due to the increase in ambient air temperatures and the effects of protective outer wear decreasing body ventilation, there exists an increase in the potential for injury, specifically heat casualties. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures, and the prevention of heat stress casualties. A Heat and Casualty Prevention Plan appears in Appendix E-1. It describes the identification and treatment for heat exhaustion and heat stroke, and lists the precautions to be taken in order to prevent heat stress at the HCC site.

The list of equipment that will be maintained on-site for use in the event of an emergency follows:

1. Emergency eye wash and shower.

2. Twenty pound ABC type dry chemical fire extinguishers.

3. Self-contained breathing apparatus for emergency use.

4. Emergency tools.

5. An industrial first-aid kit.

E. <u>Personnel Training</u>

All personnel will be trained in accordance with the OSHA requirements given in 40 CFR Part 1910.120(e) prior to working at this site. All on-site personnel directly involved in study activities will be briefed by the on-site manager/safety officer on levels of personnel protective equipment required for site study activities, safety and hygiene procedures, general cleanup procedures, symptoms of chemical exposure, heat/cold stress, study area entry and exit, and notification of emergency personnel. Periodic safety meetings will be held, as necessary, to inform these workers of changes in the safety plan and/or area conditions.

VII. Decontamination Procedures

Decontamination Procedures will be used when contact is made with the soil and perched water in the Exclusion Zones. All decontamination procedures will be performed in the Decontamination Zones. A Decontamination Station will be located contiguous to the Exclusion Zones. The list of procedures for personnel decontamination is provided below:

1. All boots and other contaminated garments which have come in contact with the soil will be cleaned with detergent and water in wash tubs. The wash water and residue will be collected and handled as hazardous waste.

2. All disposable garments will be removed at the Decontamination Station. The garments will be disposed of in bags or drums for later dispoosal at an approved site.

3. Spent cartridges/canisters from respiratory equipment will be disposed of in a bag or drum at the Decontamination Station.

4. Use a new set of inner gloves to clean equipment.

5. Dispose of any dirty trash in the drum provided at the Decontamination Station.

6. Depart the Decontamination Station and proceed to the Support Zone.

In addition to the procedures described above, all potentially contaminated equipment will be either steam cleaned and/or detergent washed on-site.

The decontamination equipment that will be contained at the site includes:

1. Water supply and detergent wash solutions for boot and equipment wash and rinse.

2. Trisodium phosphate.

3. Sheet Plastic.

4. Scrub brushes to clean garments and equipment.

VIII. Air Quality Monitoring

As described in Section VI-B of this HASP, air quality will be monitored at the tank farm for total organic vapors prior to conducting the site work in the tank farm. Sampling will be performed as listed below.

1. Organic vapors will be monitored using an organic vapor analyzer (OVA).

2. Background samples will be measured upwind and downwind of the tank farm area and in and around each well to be sampled prior to beginning work. Four samples will be measured in each area over an eight hour work day.

3. All measurements will be logged in a field notebook which will be provided.

4. Organic vapor monitoring will be conducted hourly during any work activities in the Exclusion Zone. Measurements will be taken at the downwind side of the Exclusion Zone.

5. When working in the Exclusion Zones at the site with Level D Protection, if total organic vapors exceed 10 ppm, workers will immediately move upwind of the work area and perform decontamination procedures. No one will re-enter the work area until air monitoring has been performed and the organic vapor concentration is less than 25 ppm or Level C Protection is used.

6. In the event that the total organic vapor concentration approaches 1,000 ppm, personnel working in the Exclusion Zones with Level C Protection will immediately leave the work area and perform appropriate decontamination procedures. Subsequent entry to the work area will only be allowed if the concentration fall below 1,000 ppm or Level B protection is used.

IX. Emergency Contingency Plan

A. Emergency Procedures

1. Emergency Exit Equipment will consist of self-contained breathing apparatus. They will be located in the Support Zone office.

2. Emergency fire fighting equipment, i.e., chemical extinguishers, will be maintained at the Support Zone office. In the event of a fire:

   a. A whistle will be sounded for site evacuation.

   b. The local fire department will be notified by the site manager.

   c. The chemical fire extinguishers will be employed to contain the fire, if possible.

3. Emergency evacuation of the site will occur in the event there is a fire or explosion. Workers will be signaled by a whistle, to be kept at the Support Zone office, indicating site evacuation. All workers will meet upwind of the site either at the office or on the adjacent property. The site manager is responsible to assure that all workers logged on to the site that day have been evacuated.

4. When working in the Exclusion Zones with Level D Protection, workers must move upwind of the work area, if total organic vapors exceed 10 ppm. No one may re-enter the work area unless organic vapors are less than 10 ppm or Level C Protection is used.

5. When working in the Exclusion Zones with Level C Protection, workers must move upwind of the work area, if total organic vapors exceed 1,000 ppm. No one may re-enter the work area unless organic vapors are less trhan 1,000 ppm or Level B Protection is used.

6. Emergency eye wash equipment will be maintained in the area adjacent to where work activities are occuring.

B. <u>Local Resources</u>

Fire Department, Bedford	232-1212
Police Department, Bedford	232-1234
Community Hospital of Bedford	439-2000
Poison Control Center	231-4455

C. <u>Regulatory Contact</u>

Ohio EPA Emergency Response	800-282-9378

D. Emergency Route to Community Hospital of Bedford

Beford Community hospital located at 44 Blaine Street, Bedford, Ohio is the nearest medical facility. It can be reached by taking Northfield Road north to Union Street. Make a left on Union Street (west) to Broadway. Make a left on Broadway (south) to Columbus Road. Make a right on Columbus Road (west) to Blaine Street. Make a left on Blaine Street (south) to Community Hospital.

The site manager will drive the route to the hospital before study area site activities take place.

E. Emergency Response Protocols

All emergency telephone numbers and an emergency route map to the hospital will be posted at the Support Zone office near the telephone. In the event of physical injury, the site safety officer or any other qualified person will initiate first-aid and, if necessary, call the ambulance. If the chemical exposure is encountered, a physician will be informed, as specifically as possible, of the chemical(s) to which the person has been exposed and the toxicological properties of the chemical(s). Closure area evacuation procedures and emergency response protocols will be reviewed with the site workers prior to closure area activities.

Also a schedule of work activities on the site will be provided to the fire personnel and hospital so they will know when activities are taking place. In addition, the hospital emergency personnel have been briefed on the nature of the contaminants in the study area and their health hazards. If any particularly hazardous activities will be occuring on the study area site at any time, the hospital and fire personnel will be notified.

APPENDIX E-I

HEAT AND STRESS CASUALTY PREVENTION PLAN

A. Identification and Treatment

1) Heat Exhaustion

a) Symptoms: Usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Vomiting is frequent. The bowels may move involuntarily. The victim is very pale, his skin is clammy, and he may perspire profusely. The pulse is weak and fast, his breathing is shallow. He may faint unless he lies down. This may pass, but sometimes it remains and death could occur.

b) First-Aid: Immediately remove the victim to the Decontamination Reduction Zone in a shady or cool area with good air circulation. Remove all protective outer wear. Call a physician. Treat the victim for shock. (Make him lie down, raise his feet 6-12 inches, and keep him warm but loosen all clothing.) If the victim is conscious, it may be helpful to give him sips of a salt water solution (1 teaspoon of salt to 1 gall of water). Transport victim to a medical facility.

2) Heat Stroke

a) Symptoms: This is the most serious of heat casualties due to the fact that the body excessively overheats. Body temperatures often are between 107°-110°F. First there is often pain in the head, dizziness, nausea, oppression, and a dryness of the skin and mouth. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly.

b) First-Aid: Immediately evacuate the victim to a cool and shady area in the Decontamination Reduction Zone. Removal all protective outer wear and all personal clothing. Lay him on his back with the head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels, ice bags, etc., to the head. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place him in a tub of cool water. The main objective is to cool him without chilling him. Give no stimulants. Transport the victim to a medical facility as soon as possible.

B. Prevention of Heat Stress

1) One of the major causes of heat casualties is the depletion of body fluids. On the site there will be plenty of fluids available. Personnel should replace water and salts loss from sweating. Salts can be replaced by either a 0.1% salt solution, more heavily salted foods, or commercial mixes such as Gatorade. The commercial mixes are advised for personnel on low sodium diets.

2) A work schedule will be established so that the majority of the work day will be during the morning hours of the day before ambient air temperature levels reach their highs.

3) A work/rest guideline will be implemented for personnel required to ear Level B protection, if this situation arises. This guideline is as follows:

Ambient Temperatures	Maximum Wearing Time
Above 90°F	1/2 hour
80°-90°F	1 hour
70°-80°F	2 hours
60°-70°F	3 hours
50°-60°F	4 hours
40°-50°F	5 hours
30°-40°F	6 hours
Below 30°F	8 hours

A sufficient period will be allowed for personnel to "cool down". This may require shifts of workers during operations.